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Editorial and Executive Offices
330 West 42d Street, New York, N. Y.

JAMES H. McGRAW, Jr.....President
HOWARD EHRLICH.....Executive Vice-President
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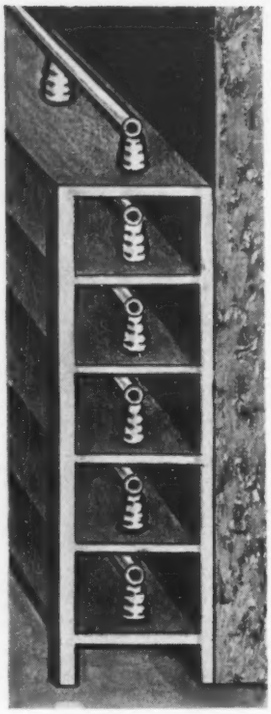

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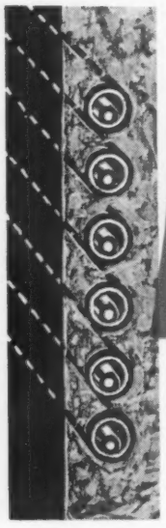

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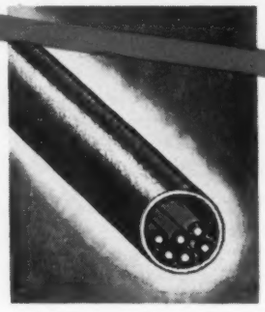

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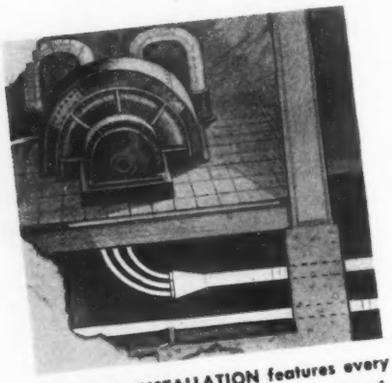

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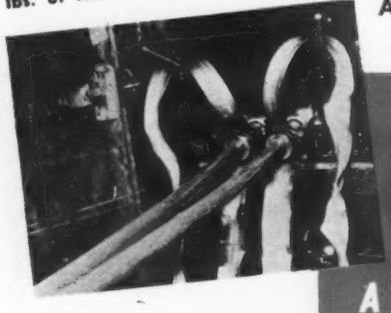

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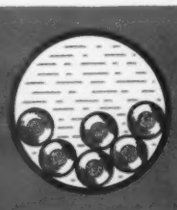


OILOSTATIC
TRANSMISSION SYSTEM
A PRODUCT OF OKONITE-CALLENDER RESEARCH

An Inventory Pool

The War Production Board, through its power branch, is asking all electric utilities to report inventories in excess of what is really needed. What this actually amounts to is the beginning of a huge pool of utility inventories which may be shared by all, thereby reducing the demand for certain of the critical materials, especially copper.

While there has been no intimation that utilities have been hoarding, the industry will welcome the idea of being given the opportunity to cooperate instead of having to give up excess inventory to the Requisitioning Branch of WPB. When that branch moves in it frequently leaves the odor of hoarding, with resulting poor publicity.

Within recent weeks some of the necessities for large inventory have disappeared. Prices have ceilings pretty generally and inventories are frozen to the point where permissible withdrawals are small. Many utilities might, therefore, find in the WPB suggestion an opportunity to turn some frozen inventory into cash. Other utilities that are having trouble getting supplies under existing priority classifications might find quick relief in such a program.

One important angle to the arrangement is that a utility with frozen inventory may under this program sell supplies to another utility, or back to the supplier, without charging such withdrawals to inventory under P-46 limits. However, utilities buying such materials from another utility must be in a position to accept delivery without exceeding Section F limits. There is no license in this plan for a utility to get materials to engage in any operation that is otherwise forbidden by WPB orders.

This is an opportunity for electric utilities to show how thoroughly they are behind the war effort. They can answer WPB's call according to the letter and state merely the inventory in excess of Section F provisions, or they can answer it in the spirit of real cooperation and report all that isn't expected to be needed, even if some of it might properly be held.

Obviously, there will be some instances where the decision will not be easy to make, especially in view of the present copper situation. When it is stated that for several months at least the utilities will get no more than half their requirements of new copper, one must take this element into consideration in reporting excess inventory.

In any event WPB has no intention of doing anything more than compiling the lists and making them available. All sales negotiations will be between the interested parties. For that reason the program seems to need one further element, namely, some agency to be the go-between. Merely to offer a list of available supplies with the names of the owners is not enough because of the complications that can result from such an arrangement. It would be much better if some agency were to handle all inquiries and put those needing material in touch with those who had it. This would eliminate considerable correspondence, avoid delays and perhaps pyramided inquiries.

Safe Transformer Overloads Readily Calculable

Working curves and tabular forms devised by the author in applying Montsinger's principles and A.S.A. guide for operation of transformers

R. O. LOOMIS, Operating Department, Georgia Power Company

OPERATING MEN know that transformers will carry overloads for short periods of time. The A.S.A. guides for operation of transformers provide readily usable methods for determining safe overload limits for transformers of conventional design. There are many transformers in service which were purchased for special conditions, or with oil rises less than 55 deg. When calculating allowable loads on such transformers, it is convenient to have a form with places for each step in the calculations. Unless the basic data, assumptions and calculations are all put down in an orderly manner, it is difficult to check the calculations and to revise them six months or a year later. It is the purpose of this paper to provide such forms. No attempt is made here to determine the effect of temperatures on life, but the temperature limits in the A.S.A. guides are used.

Aging of transformer insulation depends upon both time and temperature. Each increase in temperature of 8 deg. C. is estimated to double the rate of aging. Satisfactory transformer life is expected with the temperature of insulation (copper) maintained at 95 deg. C. continuously. This temperature normally would result from 30 deg. C. daily average ambient plus 55 deg. C. average temperature rise of windings (due to rated load) plus 10 deg. C. increase above average for the hottest spot in the windings at rated load. Since practically no transformers carry rated load continuously, and ambient temperatures are not 30 deg. C. continuously, the hottest spot in the windings is not 95 deg. C. continuously, but some figure much less than this a large part of the time. Therefore satisfactory transformer life will be obtained if the hottest spot temperature exceeds 95 deg. C. either occasionally or regularly for short periods of time, due either to higher ambients or higher loads. The A.S.A. has set the following limits on hottest spot temperature of transformer windings:

Recurring daily in any 24-hour period		
2 hours	8 Hours	24 Hours
110 deg.	105 deg.	95 deg.
Emergencies occurring infrequently		
2 Hours	8 Hours	24 Hours
115 deg.	110 deg.	105 deg.

Chemical breakdown of cellulose insulation may occur above 120 deg. C., so the temperature should not exceed this value.

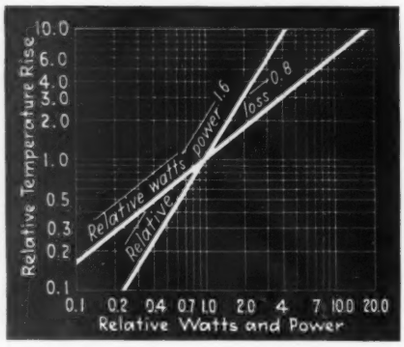


FIG. 1—Relative watts and power for relative temperature rises; see text for explanation of exponents

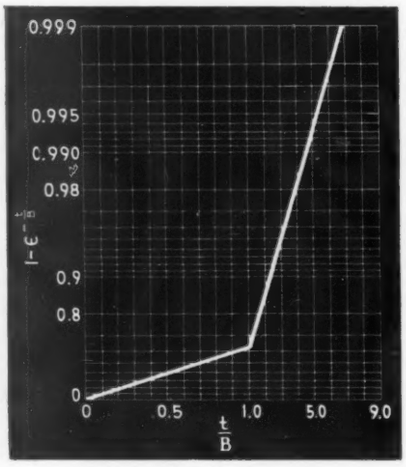


FIG. 2—Chart determines from t/B the ratio of initial to ultimate oil-temperature rises

When it is desirable to calculate allowable loads on transformers other than standard 55 deg. rise it is possible to estimate the temperature rise resulting from a given load cycle on a given transformer from nameplate data and data given on the manufacturer's test sheet. The general method is to start from some known or steady state top-oil temperature rise (above ambient) and calculate the top-oil rise resulting from a different load condition for a given time. Then the hot-spot copper temperature rise above top-oil temperature for the load involved is calculated. Since this becomes constant in 20 or 30 minutes, only the ultimate value is calculated. This does not apply to momentary peaks of a few minutes duration. Then the existing ambient temperature, top-oil rise above ambient, and hot-spot rise above top oil are added together to obtain actual hot-spot temperature. The steps and equations involved are as follows:

1. Obtain kva. rating and guaranteed average copper temperature rise from nameplate.

2. Obtain tested ultimate top-oil rise at rated load and average copper rise at rated load from factory test sheet. Both these will be above ambient. Also obtain iron and copper losses in watts at 100 percent load, weight of core and coils in

pounds, weight of tank in pounds, and gallons of oil.

3. Hottest spot is 10 deg. C. above average copper temperature at rated load.

4. Subtract top-oil rise from hottest spot rise at rated load to obtain hot-spot rise over top-oil. For other loads, this rise varies as the load raised to the 1.6 power (See Fig. 1).

5. The *ultimate* top-oil temperature rise above ambient at loads other than 100 percent varies as the 0.8 power of the losses for self-cooled transformers. For other transformers the rise varies more nearly as the first power of the losses.

6. Copper losses vary as the square of the load. Iron losses are assumed not to vary.

7. The deg. C. *change* in oil temperature rise at any time $t = T_c$

For rising temperature $T_c = (T_u - T_i)\left(1 - \epsilon^{\frac{-t}{B}}\right)$

Where:

T_u = ultimate oil temperature rise above ambient in degrees C.

T_i = initial oil temperature rise above ambient in degrees C.

t = time in hours

E = 2.718

$$B = \frac{C \times T_u}{\text{Watts loss causing ultimate rise}}$$

$$C = \frac{3.5\ (\text{lb. core and windings} + 2/3\ \text{lb. tank}) + 90\ (\text{gal. oil})}{60}$$

The watts loss causing ultimate rise may be taken as the watts loss at initial temperature.

8. When the initial rise T_i over ambient for a given load is constant, and a new load is applied, one method of calculating the oil rise (accurate enough for practical purposes) is to base B on $(T_u - T_i)$ and the loss causing $(T_u - T_i)$—that is, the additional loss caused by the higher load.

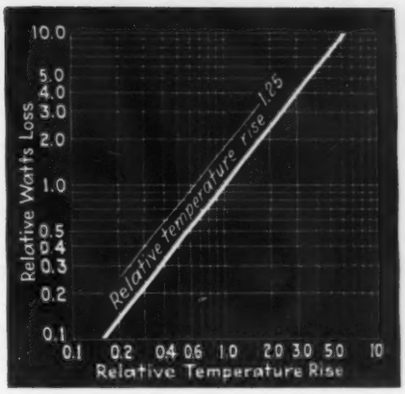


FIG. 3—Temperature rise and watts loss on basis of 1.25 power

The second and more accurate method is to find the time (starting from the beginning of the new load) that would be required, at the new load, to reach the initial rise and add this to the time periods used thereafter. In this case

$$B = \frac{C \times T_u}{\text{watts loss for new load}}$$

But, under the condition where the initial temperature rise over either the ambient (or over some constant rise for a given load) is not constant, the second method should be used.

Since

$$T_c = (T_u - T_i)\left(1 - \epsilon^{\frac{-t}{B}}\right)$$

When

$T_i = 0$ (starting from 0 temp. rise)

$$\frac{T_c}{T_u} = 1 - \epsilon^{\frac{-t}{B}}$$

Where:

T_c = initial oil rise at beginning of second period

T_u = ultimate oil rise at load of second period

From Fig. 2 determine $\frac{t}{B}$ from value of

$$\left(1 - \epsilon^{\frac{-t}{B}}\right)$$

Multiply $\frac{t}{B}$ by B to obtain equivalent time

Add equivalent time to time of second period and calculate final temperature which equals

$$T_u\left(1 - \epsilon^{\frac{-t}{B}}\right)$$

9. For rising temperatures the hottest spot temperature of copper at time t equals:

Hot spot rise over top oil plus $(T_i + T_c)$ plus ambient temperature

10. For falling temperatures the top oil rise at time

$t = T_i - T_c$

Where $T_c = (T_i - T_u)\left(1 - \epsilon^{\frac{-t}{B}}\right)$

The curve of falling temperature will be similar to the curve of rising temperature, and T_c is calculated as though the temperature were rising. Therefore B in this case must be calculated for the losses causing an ultimate temperature rise of

Form 1—Calculation of Power Transformer Temperatures for Various Shape Load Curves

Data to be obtained from Test Sheets:				Name Plate Data	
1a. Losses at 100% load — Iron	7030	Watts		Manufacturer	-------
1b. — Copper	16430	"		Serial No.	-------
1c. — Total	23460	"		KVA	3000
2. Ultimate top oil rise at 100% load	41	°C		Type	-------
3. Ultimate avg. copper rise at 100% load	49.5	°C		°Cent. Temp. Rise	-------
4. Hot spot rise at 100% load [(3) + 10°]	59.5	°C			
5. Hot spot rise over oil @ 100% load (4) − (2).	18.5	°C			
6. Weight core and coils	18200	lb. × 3.5	=	63700	
7. Weight tank	8050	lb. × 3.5 × .67	=	18800	
8. Gallons oil	2160	gal. × 90	=	194300	
9. Total				276800	
10. Constant C = (9) ÷ 60			C =	4615	

Rising Temperatures

	Initially A	Followed by B	Followed by C
11. Times rated load	0.667	1.5	
12. Time in hours at load (11)	11.	2.	
13. Copper loss at load (11) = (11)² × lb	7320.	37000.	
14. Iron loss = 1a	7030.	7030.	
15. Total loss at load (11) = (13) + (14)	14350.	44030.	
16. Ultimate oil rise at load (11) = $\left[\frac{(15)}{(1c)}\right]^{0.8} \times (2)$. See Fig. 1.	27.9	67.6	
17. Initial oil rise = (26) in preceding column*	24.	26.7	
18. Difference for rising temp's = (16) − (17)	3.9	40.9	
19. Time Constant B = $\frac{(10) \times (16)}{(15)}$	8.99	7.1	
20. $1 - \epsilon^{\frac{-t}{B}}$ = (17) ÷ (16)	0.86	0.395	
21. $\frac{t}{B}$ from (20) and Fig. 2	1.97	0.505	
22. Equiv. time to reach temp. (17) = (19) × (21)	17.7	3.58	
23. Total equiv. time = (22) + (12)	28.7	5.58	
24. $\frac{t}{B}$ for time (23) = (23) ÷ (19)	3.19	0.785	
25. $1 - \epsilon^{\frac{-t}{B}}$ from (24) and Fig. 2	0.957	0.545	
26. Total oil rise at time (12) = (25) × (16)	26.7	36.8	
27. Ultimate copper hot spot rise over oil = $\frac{1.6}{(11) \times (5)}$		35.2	
28. 24 hour average ambient temp. from Fig. 4 or otherwise		15.	
29. Oil temp. at end of time (12) = (26) + (28)		51.8	
30. Hot spot copper temp. = (27) + (29)		87.0	

* For Column A, determine (17) by observation or by assuming a reasonable load to exist indefinitely, and calculate as in (16)

Item (30) should not exceed the following:

Recurring Daily in Any 24-Hr. Period			Emergencies		
2 hours	8 hours	24 hours	2 hours	8 hours	24 hours
110°	105°	95°	115°	110°	105°

T_i. The equation for these losses, derived from (5) is:

$$\text{Watts loss producing } T_i = \text{loss at } 100\% \text{ load} \times \left(\frac{T_i}{\text{Ult. rise at } 100\% \text{ load}}\right)^{1.25}$$

$$\text{Then } B = \frac{C \times T_i}{\text{Watts loss producing } T_i}$$

In order to make the calculations in an orderly fashion, forms are shown giving the calculations by steps and charts used to simplify the arithmetic.

Form 1 is used for all steps in the load curve involving rising temperatures. Form 2 is used for steps in the load curve involving falling temperatures. Form 3 is a slight simplification of Form 1 for rising temperatures and will give results close enough for practical purposes. For preliminary or approximate results Form 1 may be used with one value of B calculated for 100 percent or 125 percent load.

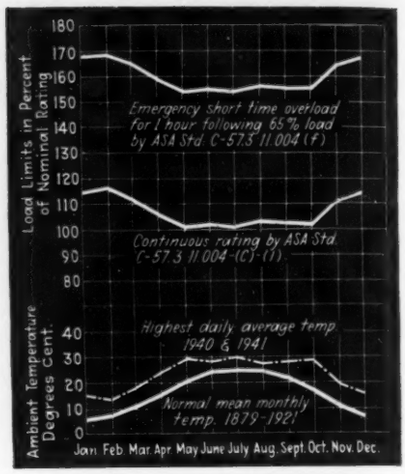

Load Limits in Percent of Nominal Rating
Emergency short time overload for 1 hour following 65% load by ASA Std. C-57.3 11.004 (F)
Continuous rating by ASA Std. C-57.3 11.004-(C)-(1)
Ambient Temperature Degrees Cent.
Highest daily average temp. 1940 & 1941
Normal mean monthly temp. 1879-1921
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.

FIG. 4—Load limits for standard O.I.S.C. transformer ratings in Atlanta based on highest daily average 1940-41 temperature

Form 2—Calculation of Power Transformer Temperatures for Various Shape Load Curves

Data to be obtained from Test Sheets:

(Same as for Form 1)

Falling Temperatures

Column	Initially A	Followed by B	Followed by C
11. Times rated load	0.333		
12. Time in hours at load (11)	11.		
13. Copper loss at load 11 = (11)² × (lb)	1825.		
14. Iron loss = (1a)	7030.		
15. Total loss at load (11) = (13) + (14)	8855.		
16. Ultimate oil rise at load (11) = $\left(\frac{(15)}{(1c)}\right)^{0.8} \times (2)$. See Fig. 1.	19.1		
17. Initial oil rise = (34) in preceding column*	36.8		
28. Difference for falling temp. = (17) − (16)	17.7		
29. Watts loss = $\left[\frac{(17)}{(2)}\right]^{1.25} \times (1c)$. See Fig. 3	20400.		
30. $B = \frac{(10) \times (17)}{(29)}$	8.34		
31. $\frac{t}{B} = (12) \div (30)$	1.32		
32. $1 - \epsilon^{\frac{t}{B}}$ from (31) and Fig. 2	0.735		
33. Temp. decrease in time (12) = (28) × (32)	13.0		
34. Total oil rise at time (12) = (17) − (33)	23.8		

* From Form 1, use line (26).

Form 3—Calculation of Power Transformer Temperatures for Various Shape Load Curves

Data to be obtained from Test Sheets:

(Same as for Form 1)

Rising Temperatures

Column	Initially A	Followed by B	Followed by C
11. Times rated load	0.667	1.5	
12. Time in hours at load (11)	11.	2.	
13. Copper loss at load (11) = (11)² × (lb.)	7320.	37000.	
14. Iron loss = (1a)	7030.	7030.	
15. Total loss at load (11) = (13) + (14)	14350.	44030.	
16. Ultimate oil rise at load (11) = $\left(\frac{(15)}{(1c)}\right)^{0.88} \times (2)$ See Fig. 1.	27.9	67.6	
17. Initial oil rise = (23) in preceding column*	24.	26.8	
18. Difference for rising temp. = (16) − (17)	3.9	40.8	
19. Time constant $B = \frac{(10) \times (16)}{(15)}$	8.99	7.1	
20. $\frac{t}{B} = (12) \div (19)$	1.22	0.282	
21. $1 - \epsilon^{\frac{t}{B}}$ from (20) and Plate 2	0.71	0.24	
22. Temp. increase in time (12) = (18) × (21)	2.8	9.8	
23. Total oil rise = (22) + (17)	26.8	36.6	
24. Ultimate hot spot rise over oil = (11)$^{1.6}$ × (5)		35.2	
25. 24-Hour average ambient temperature from Fig. 4 or otherwise in deg. C		15.	
26. Oil temperature at time t = (23) + (25)		51.6	
27. Hot spot copper temperature (26) + (24)		86.8	

* For Column A, determine (17) by observation or by assuming a reasonable load to exist indefinitely, and calculate as in (16).

Item (27) should not exceed the following:

Recurring Daily in Any 24-Hr. Period			Emergencies		
2 hours	8 hours	24 hours	24 hours	8 hours	24 hours
110°	105°	95°	115°	110°	105°

Figs. 1 and 3 can be prepared full size by using log-log graph paper. Since 1 to any power is 1, all lines pass through point 1, 1. Using the following values all lines can be drawn as straight lines on log-log paper:

$5^{0.8} = 3.62 \qquad 5^{1.25} = 7.48 \qquad 4^{1.6} = 9.19$

Fig. 2 can be drawn using the following values. By using semi-log paper with cycles inverted and numbered as shown, the graph will be a straight line.

$\frac{t}{B}$	$1 - \epsilon^{\frac{-t}{B}}$	$\frac{t}{B}$	$1 - \epsilon^{\frac{-t}{B}}$
0.1	0.0952	4.	0.9817
0.5	0.3934	5.	0.9933
1.0	0.6321	6.	0.9975
2.	0.8646	8.	0.9995
3.	0.9502	10.	0.99995

The author wishes to express his appreciation for the constructive criticisms offered by V. M. Montsinger during the preparation of this article.

Fault Bus-Differential Scheme Protects Cahokia Bus

Combination fault-bus differential system provides individual bus isolation without disturbing interconnections of remaining bus — Applied when conventional fault-bus or differential schemes were impractical alone

GORDON W. GERELL, Protection Engineer Union Electric Company of Missouri, St. Louis*

A UNIQUE bus protection scheme that is a combination of fault-bus and differential systems is being used on the double generator bus at Cahokia station. It is designed to meet the need for a form of protection that, in event of a fault, would isolate either bus in a section by tripping the breakers, without disturbing interconnections with adjacent buses of the other bus in the same section.

The innovation was made in 1939 when a new generator was added and a complete rearrangement of the 13,800-volt generator bus was undertaken at this station. The plan of the new bus is as given in the sketch, which shows three of the six actual plant bus sections. Interconnection of the east and west bus is through double-winding generators in bus sections No. 1 and No. 6. Any bus section consists of two buses, designated as "east" and "west" bus.

Plant construction made it essential that a fault-bus unit include a complete bus section, consisting of both buses. Consequently, use of conventional fault-bus protection would cause tripping of both buses in a section and all four bus tie breakers to adjacent bus sections. This would separate the plant into two component parts.

Selective Tripping

However, it was desired that the protection system would isolate a fault on any one bus by tripping only breakers on that bus, in no way disturbing the interconnection of the other bus with adjacent buses. This was obtainable by any one of several schemes. For example: (1) A complete differential system might have been applied to each individual bus; the great multiplicity of circuits made such a system rather impractical and expensive. (2) The two buses within the bus section could have been completely isolated from each other, but since the plant was not designed originally for such an arrangement, the cost would have been prohibitive.

Scheme Adopted

As finally adopted the protective scheme consists of a combination fault-bus differential system. Each of the bus sections (see diagram), consisting of an east and west bus, comprises a fault-bus unit. Each bus tie compartment also comprises a fault-bus unit. All of the equipment bases in each unit are connected together, and then to ground through a ground riser. In series with this ground riser is a high-speed, induction, overcurrent relay, referred to as the fault-bus relay, which controls the operation of an auxiliary tripping relay.

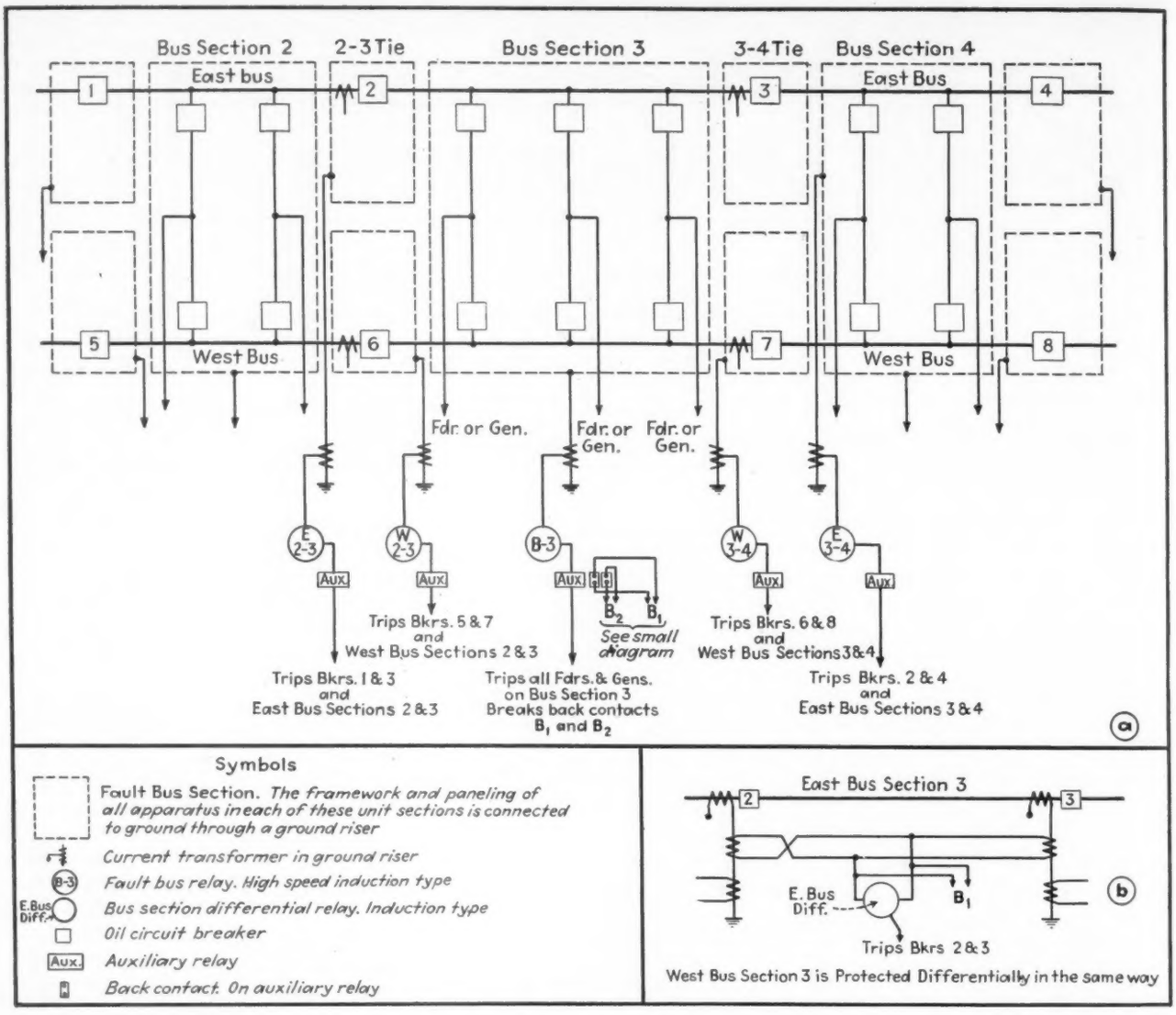
In addition, current transformers are installed in each of the bus-tie breaker positions, with a differential relay connected between the two sets of current transformers of any one particular bus. The fault-bus relay is arranged to trip all of the feeder circuits in the bus section, but not the bus tie breakers. A back contact of the fault-bus auxiliary relay is connected normally to short circuit the operating coil of the differential relay, the contacts of which are arranged to trip the bus tie breakers of the particular bus to which it is connected.

Operating Principle

Operation of the scheme depends upon the location of the fault. The zone of protection provided by any one fault-bus unit includes not only the feeder oil circuit breakers and such other equipment as previously mentioned, but a portion of the outgoing cable circuits as well. This is unavoidable due to the fact that the cables must of necessity enter the switch-house structure which fundamentally makes up the several fault-bus units. Should this fault occur on a feeder beyond the feeder oil circuit breaker, but within the zone of protection provided by the fault bus unit, the operation will be as follows:

The fault bus relay immediately operates to trip all of the feeder and generator circuits connected to both of the buses within the faulted bus section. Such operation isolates the fault without affecting the main plant buses, since the differential relay has a time delay (after it has been released by the auxiliary relay) sufficient to permit clearing the breaker on the faulted circuit. Should the fault occur on one or the other of the two buses within the faulted bus section tripping of all of the feeder breakers does not clear the fault. The two differential relays, however, have had the short circuit removed from their operating coils and, therefore, become operative. That one protecting the faulted bus section, of course, operates and trips the two bus-tie breakers of that bus which isolates

* The author acknowledges important parts played by H. O. Duetscher and E. L. Hough and their staffs in the engineering and installation of the protective scheme.


Bus Section 2
2-3 Tie
Bus Section 3
3-4 Tie
Bus Section 4
East bus
East Bus
West Bus
West Bus
Fdr. or Gen.
Fdr. or Gen.
Fdr. or Gen.
Trips Bkrs. 5 & 7 and West Bus Sections 2 & 3
See small diagram
Trips Bkrs. 6 & 8 and West Bus Sections 3 & 4
Trips Bkrs. 1 & 3 and East Bus Sections 2 & 3
Trips all Fdrs. & Gens. on Bus Section 3 Breaks back contacts B1 and B2
Trips Bkrs. 2 & 4 and East Bus Sections 3 & 4
Symbols
Fault Bus Section. The framework and paneling of all apparatus in each of these unit sections is connected to ground through a ground riser
Current transformer in ground riser
Fault bus relay. High speed induction type
Bus section differential relay. Induction type
Oil circuit breaker
Auxiliary relay
Back contact. On auxiliary relay
East Bus Section 3
E. Bus Diff.
Trips Bkrs 2 & 3
West Bus Section 3 is Protected Differentially in the same way

SCHEMATIC ARRANGEMENT of combination fault bus-differential protection scheme used on 13,800-volt generator bus at Cahokia station. Sketch (a) shows fault-bus elements; (b) shows differential arrangement for one bus

the fault. The non-faulted bus within the protected zone does not trip out and, therefore, the plant interconnection is maintained as desired.

Operation on fault within one of the bus-tie compartments is slightly different. The fault-bus relay connected to this particular fault-bus unit operates to trip all of the outgoing feeders and generators connected to the two adjacent buses and to trip the bus-tie breakers at the far ends of these two buses. Again the plant interconnection is not disturbed.

Operating Experience

The protective system as described in the foregoing was placed in service at the Cahokia plant during May, 1939. It has had occasion to operate on three instances, twice during January, 1940, and again in September, 1940.

In the first instance the west bus No. 2 feeders, west bus No. 3 feeders, No. 1-2 west bus-tie and No. 3-4 west bus-tie tripped. Relay operations indicated immediately that the fault had occurred in the west bus 2-3 junction compartment. Subsequent investigations revealed this to be the case, enabling service to be restored within seventeen minutes after the inception of the fault.

In the second instance primary bushings on one of the feeder transformers failed, causing the circuit to relay properly. In addition, current appeared in the No. 1 section ground riser, which is the section to which the feeder was connected, causing the fault bus system to operate again. Subsequent relay and switch operations were correct, assuming that ground current rightfully appeared in the ground riser. This caused tripping of all feeders connected to the bus supplying the faulted circuit. The differential relays, even though released for operation, did not operate, which is correct.

In the third instance, a fault developed in a line-side oil-switch bushing connected to No. 5 bus section. The relay connected to the ground riser of this section operated to trip all circuits connected to No. 5 east and west buses, which cleared the short circuit. The adjacent bus-tie switches remained closed, thereby maintaining the continuity of the main generator buses.

In addition, numerous faults have occurred on the 13,800-volt feeders beyond the protective zone without operating the fault bus protective equipment. This indicates in a negative sense that the protective relays are functioning correctly.

Capacitors Help Attleboro Lift Power Factor, Cut Peak

Peak cut 21.4 percent and power factor raised from 70 to 90 percent — Substation banks and distribution circuit units are employed with automatic step control of service rendered by banks

H. W. THOMPSON, New England Power Service Company, Boston, Mass.

INSTALLATION of 5,340 kva. in 15-kva., single-phase, individually fused unit-type capacitors on the distribution feeders and at the West Street substation of the Attleboro (Mass.) Steam & Electric Company has effectively reduced the substation peak load from 7,000 to 5,500 kva. by improving the power factor from 70 to approximately 90 percent. This installation has solved a problem which arose from the fact that the substation, which is fed by two 22-kv. circuits from the Narragansett Electric Company (Providence, R. I.) and by a 66-kv. line from the New England Power Company system, did not have sufficient firm transformer capacity, while the existing 4-kv. bus regulator was already operating through its full voltage range.

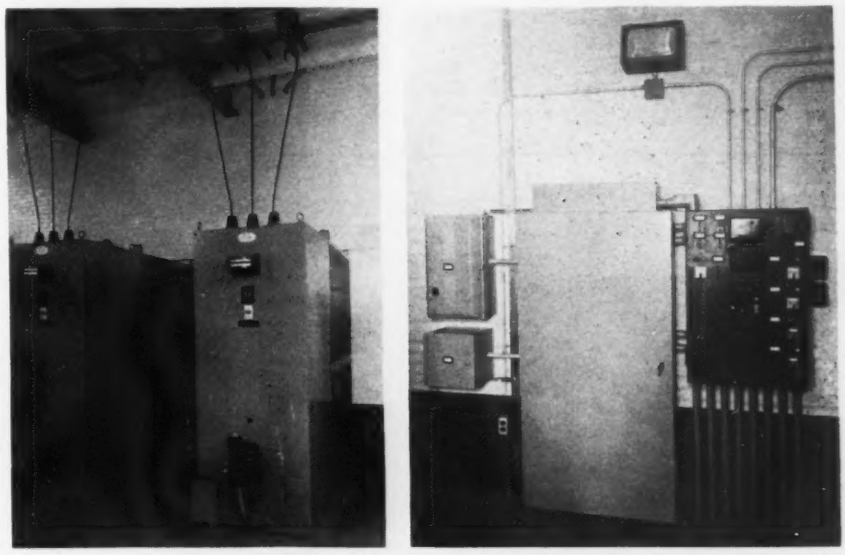
Capacitors Won Out

Studies were made comparing synchronous condensers of 5,000 and 7,500 kva. rating with various units of static condensers. A synchronous unit installed in the substation would necessarily have to anticipate the indefinite future, and therefore its long-term economical size was difficult to determine. Moreover, the seven regulated 4-kv. distribution feeders would not be relieved of their excess current and accompanying voltage drops due to poor power factor unless corrective equipment was placed near the load. A failure of any part of a synchronous condenser installation usually causes a loss of its entire corrective capacity, whereas any loss of static capacitors would probably be limited to but a few small units. The flexibility of placing the static capacitor units, their relatively low losses, low maintenance cost and the desirability of holding down the initial cost of the installed equipment all contributed to the decision in favor of the static condensers.

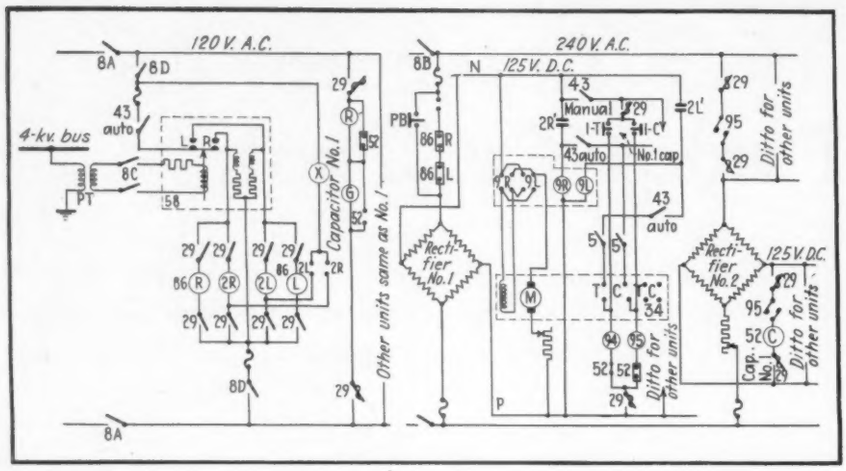
A total of 1,740 kva. in capacitors was installed on the distribution feeders. This was the maximum allowable based on the fact that they were to be left in service continuously and would not be disconnected during light load periods. The distribution system had recently been changed from a 2,300-volt, three-wire to a 4,000-volt, four-wire layout. Considerable rehabilitation work had been carried on due to the damage wrought by the 1938 hurricane. This resulted in the establishment of up-to-date records and a well-balanced system, which simplified the "spotting" of the outdoor capacitors, some of which were already in service, on the overhead and the underground feeders in such groups and locations as would minimize distribution losses.

It has been estimated that a saving was thus made of 40,000 kw.-hr. per year over the loss reduction which would have been obtained had these feeder capacitors been installed in large banks at the substation. There was also the saving of additional switching equipment and building space which would have been necessary at that point.

The feeder capacitor units are fused at only slightly above their full-load current rating in order that



TWO OF FIVE Cornell-Dubilier indoor type 720-kva. capacitor banks at West Street substation (left). Control equipment (Staley) for indoor capacitors at West Street. Left to right, d.c. rectifiers, cabinet for oil circuit breaker and closing contactor equipment, and automatic control panel (right)



AUTOMATIC control for capacitors

1—O.C.B. control switch—trip and close.
2—Timing relays—Minimizes number of operations due to short time voltage fluctuations.
5—Toggle switch—Removes auto. control from individual capacitor units.
8—Toggle switch—Power control.
9—Auxiliary relays used as reversing switch.
29—Switch used for testing or maintenance.
34—Motor-driven mercury switch. Selects capacitor units.
43—Master manual to automatic transfer switch.
52—Oil circuit breaker.
58—Voltage regulating relay—Raise and lower.
86—Timing relays—Cut off 34 when maximum raise or lower conditions are reached.
94—O.C.B. trip coil.
95—O.C.B. closing contactor.
PB—Push-button shunting auto. control used during remote electrical operation of O.C.B.'s.
(x) Auxiliary relay.

It is assumed that all switches, contactors and oil circuit breakers are open and none of the capacitors are in service and it is desired to place the equipment in full automatic operation. It is further assumed that the bus voltage is low.

I. All test switches No. 29 are closed, followed by Nos. 8A, 8B, 8C and 8D.

II. Master switch No. 43 is closed into the automatic position. Voltage regulating relay No. 5R closes its "Raise" contact. Timing relays Nos. 2R and 86R are energized. Relay No. 2R, set for a relatively short time, closes the auxiliary relay "X" circuit. Since relay No. 86L is de-energized and relay No. 86R has not completed its timing cycle, their contacts 86R and 86L are closed. Hence the control rectifier No. 1 is energized, starting the controller No. 34 as soon as contact $2R^1$ is closed to energize relay No. 9R. The motor drives the controller until the first mercury switch of the closing sequence is operated. This completes the circuit through the oil circuit breaker, closing contactor No. 95, which in turn closes the solenoid circuit of the oil circuit breaker, placing a capacitor bank in service.

III. If adding this capacitor to the bus gives satisfactory voltage conditions, the voltage regulating relay contact R opens and the timing relays instantly reset, stopping the controller.

IV. If, however, the bus voltage remains low, the controller advances to close, at approximately 20-second intervals, additional oil circuit breakers until all five capacitor units are in service. If a balance in voltage is now reached the timing relays reset and the equipment is ready for cutting capacitors out of service in the reverse order.

V. If the bus voltage remains low after all capacitors are in service, the controller will advance to again attempt to close the first, second and possibly the third oil circuit breakers of the sequence. The No. 86R relay bus now completes its timing cycle and cuts off the controller.

VI. If at any time the voltage becomes too high, the reverse of the closing operations takes place, utilizing the timing relays Nos. 2L and 86L, in conjunction with the controller, now going in the reverse or "lower" direction, until the desired number of capacitors have been disconnected.

Since controller No. 34 can rotate in either direction, repeating the complete operating cycle, it has no fixed start of sequence of closing or opening of the oil circuit breakers. However, the order is fixed and will be No. 1, 2, 3, 4, 5 or any other order such as No. 4, 5, 1, 2, 3 wherein the units are considered as being arranged in a circle. This results in averaging the number of operations and hours duty on the five capacitor banks.

Any capacitor oil circuit breaker can be opened or closed by pressing the push button PB and simultaneously operating the corresponding breaker control switch.

If it is desirable to keep any capacitor in or out of service, this can be done by throwing to the "off" position the corresponding tumbler switch No. 5, which removes the automatic control from that oil circuit breaker.

The controller is arranged for resetting to care for any number of capacitor banks up to the ultimate eight planned for in the future.

On the 4-kv. bus a three-phase induction regulator is set up for automatic operation. The regulator control current transformer is interconnected differentially with a current transformer in the main leads to the capacitor bus. This arrangement prevents hunting of the bus regulator.

Wherever capacitors are placed in operation on a bus already having units of this type in service a practically instantaneous discharge occurs from the live capacitors into the newly energized equipment. A current flow which would otherwise be destructive is minimized by means of some sort of choke, which in the Attleboro case was provided by a set of current transformers in the leads between the capacitors and the bus. In order to improve the choke effect, the secondary burdens of the current transformers were increased by connecting either ammeters or other available inductance in the secondaries.

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they may be quickly removed from the lines in case of trouble.

Substation Units Sectionalized

At the substation five capacitor banks of 720 kva. each were installed in racks in an extension to the present building; space has been reserved for three additional banks. Each bank is provided with a solenoid-operated oil circuit breaker and can be separated from the capacitor bus by disconnecting switches operated by hook stick. The capacitor bus is tied to the substation bus through an automatic circuit breaker. Drainage coils and grounding facilities are also provided. Current transformers were installed in the leads to each bank for current indication and to act as choke coils to minimize transient surge current between capacitor banks during switching operations.

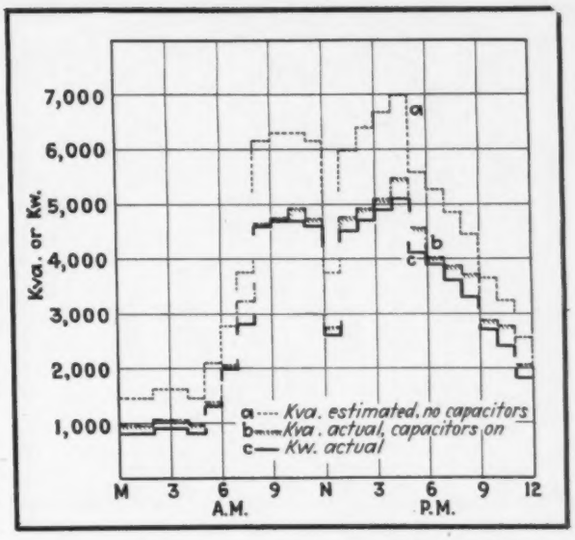
The substation installation is somewhat unique as it functions in a way similar to a step-type automatic feeder-voltage regulator. A contact-making voltmeter is arranged with a time delay to minimize operations of the individual breakers and to instigate the placing and removal one at a time of the banks in service as called for by the change of the substation bus voltage. A rotary selector switch makes it possible to employ only one oil circuit breaker closing rectifier for the five banks. This selector switch is adjustable for speed and automatically cuts out of service when correction beyond the range of the capacitors is reached.

Any bank can be placed under manual operation by throwing a tumbler switch. Since every change in the number of banks connected to the bus changes the power factor, and therefore affects the current flowing through the bus regulator, the totalizing current transformer on the capacitors is interconnected with the bus regulator line-drop-compensator

current transformer so that hunting by the bus regulator is eliminated. It has been observed at high load periods with two transformer banks operating that each capacitor bank corresponds to about 1.25 percent in voltage regulation, whereas a maximum step of 4 percent in regulation per capacitor bank obtains when operating at light load with minimum transformer and transmission facilities.

Resonance Unlikely

Preliminary oscillographic records indicated an appreciable amount of fifth and seventh harmonics in the original wave form. Therefore, although capacitor resonance troubles reported by the industry are rare, it was felt that this possibility should be thoroughly investigated. Tests made with the assistance of engineers of the New England Telephone & Telegraph Company after completion of the indoor job, but before finishing the distribution feeder capacitor installation, failed to disclose any resonance condition among some 75 combinations of conditions which were tried. It is probable that in the future, in view of these tests covering a wide range and the successful operating experience of these units, there will be very little concern about resonance in selecting capacitor installations for use on this system. A change of size or relocation of capacitors can readily be made in cases where resonance proves to be a problem after installation.



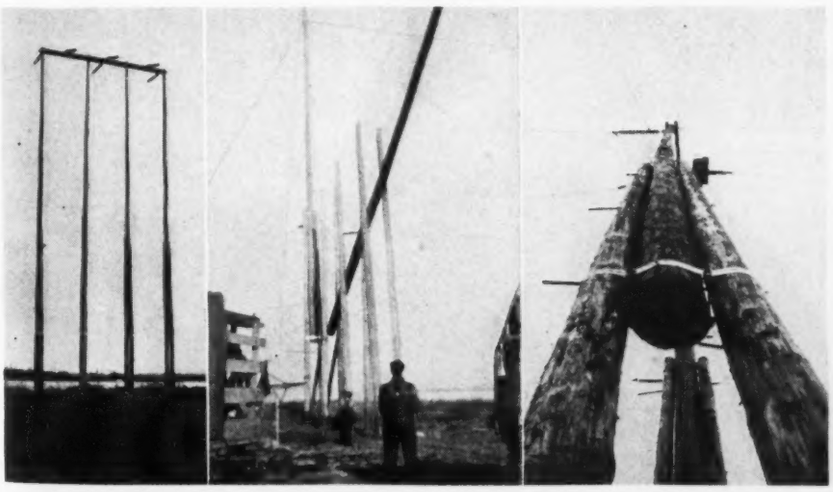
TYPICAL load curves showing (a) estimated kva. demand changes without capacitors; (b) kva. demand with capacitors in use; (c) kilowatt demand on substation

The accompanying chart based on a daily log shows an interesting comparison of actual and hypothetical results accruing from the installation, which it is believed has done excellent work in reducing transformer load and improving voltage, power factor and regulation.

Emergency Structure for River Crossing

Accompanying illustrations show an emergency transmission tower thrown up to replace a 265-ft., 132-kv. river-crossing tower of the Wisconsin-Michigan Power Company, across the mouth of the Fox River, which was destroyed several years ago by a severe storm. Although the emergency tower has long since been replaced, its design illustrates what can be done with limited facilities in an emergency.

To provide adequate clearance in the 1,400-ft. span over a ship channel it was necessary that the emergency tower be at least 100 ft. in height. Such a structure was obtained by bolting each of four available 80-ft. poles between four pairs of 50-ft. poles so that but one of the 80-ft. poles was 20 ft. from the ground. The supporting pairs of 50-ft. poles were set 10 ft. in the ground, leaving 40 ft. above ground. Of this out-of-ground portion the 20 ft. lapped the 80-ft. mast and was fastened to it at three points by special $\frac{3}{4}$-in. through-bolts and a number of pole panels.



EMERGENCY river crossing tower
Left—Bolting 80-ft. poles between pairs of 50's replaces 265-ft. tower downed by storm. Center—Poles were raised by pivoting the butt between supporting 50-ft. poles and drawing butt down with truck winch. Right—Eighty-foot sticks were bolted at three points and banded to supporting poles.

Accompanying illustrations show how the four 80-ft. poles were erected. This was done by raising the butt of the long poles until one of the three supporting through-bolts (the top one) could be passed through it and the previously set pair of 50-ft. sticks. With this bolt acting as a pivot the longer poles were raised into place by pulling down on the butt with block-and-tackle arrangement.

When the four masts were erected double 8 x 10-in. timbers were bolted across the tops to support one of the two circuits until permanent repairs could be made. The second circuit was temporarily abandoned. Conductors were No. 1/0 ACSR. The emergency structure was set between the river bank and the foundation of the demolished tower. Guys were attached to these old tower foundations.

Reactive Power Metered as In-Out Magnetizing

Clarity facilitated by labeling varmeter scales only for two-way magnetizing flow — Capacitive flow not recognized on scales

G. S. LUNGE, Central Station Engineering Department, General Electric Company, Schenectady, N. Y.

REACTIVE POWER in an alternating-current circuit might be defined as the (average) rate of *exchange* of energy between the associated electromagnetic and/or electrostatic fields and the source of excitation.

The magnetizing reactive power needed to excite inductive apparatus must be supplied from overexcited* synchronous generators, motors or condensers, or from static capacitance such as that of long transmission lines, cables or power-factor correction capacitors. Instruments for reactive power measurement are known as reactive voltampere meters, or more recently simply as "varmeters."

The present trend is to mark varmeter scales, which are usually of zero-center type, "IN" and "OUT" at their left and right ends, respectively (Fig. 1). The former practice was to mark the ends of the scale "LAG" and "LEAD" instead of "IN" and "OUT." This had several disadvantages, viz.:

(a) For tie lines, "LAG—LEAD" was meaningless unless interpreted in conjunction with the wattmeter reading. Varmeters for such circuits bore the legend ("LAG OUT") / ("LEAD IN") at the left side of the scale and ("LEAD OUT") / ("LAG IN") at the right. This implied there were four kinds of reactive power in a tie line, corresponding to the four quadrants of a tie line power factor meter (Fig. 2). Actually, since magnetizing reactive power, like active power, is an algebraic rather than a vector quantity, it can flow only in two directions, out or in. In metering reactive power it should be understood that the direction of active power flow can reverse without necessarily affecting the reactive power flow (Fig. 3).

(b) In a tie line the zero center wattmeter (marked IN-OUT) and varmeter normally deflected in op-

* "Overexcited" means here "with more field excitation than required for its own operation at unity power factor."

CONCEPT of metering reactive clearer by labeling instruments with IN-OUT reactive than by reference to four-quadrant power-factor meter

posite directions, giving the false impression that the receiving system was supplying magnetizing reactive power to the source of power supply.

(c) In a generator circuit a varmeter deflected further downscale as the magnetizing reactive power increased, whereas all other instruments in the circuit at this station read upscale (to the right).

(d) If a generator was operated as a condenser, its varmeter read LAG, whereas the varmeters of condensers elsewhere read LEAD, even though magnetizing reactive power is the same whether supplied by a generator, a synchronous condenser or a static capacitor.

New IN-OUT Marking

The new IN-OUT marking (Fig. 1) of varmeter scales is free from all of these disadvantages of the previous pactice and has this in its favor:

1. It is the same as for tie line wattmeters.

2. The varmeter itself now tells the complete story of the reactive power flow.

3. Varmeter scales for tie lines can now be just as simple as for generators.

4. Varmeters reading downscale will now call attention to the abnormal condition of the machine or machines in the station.

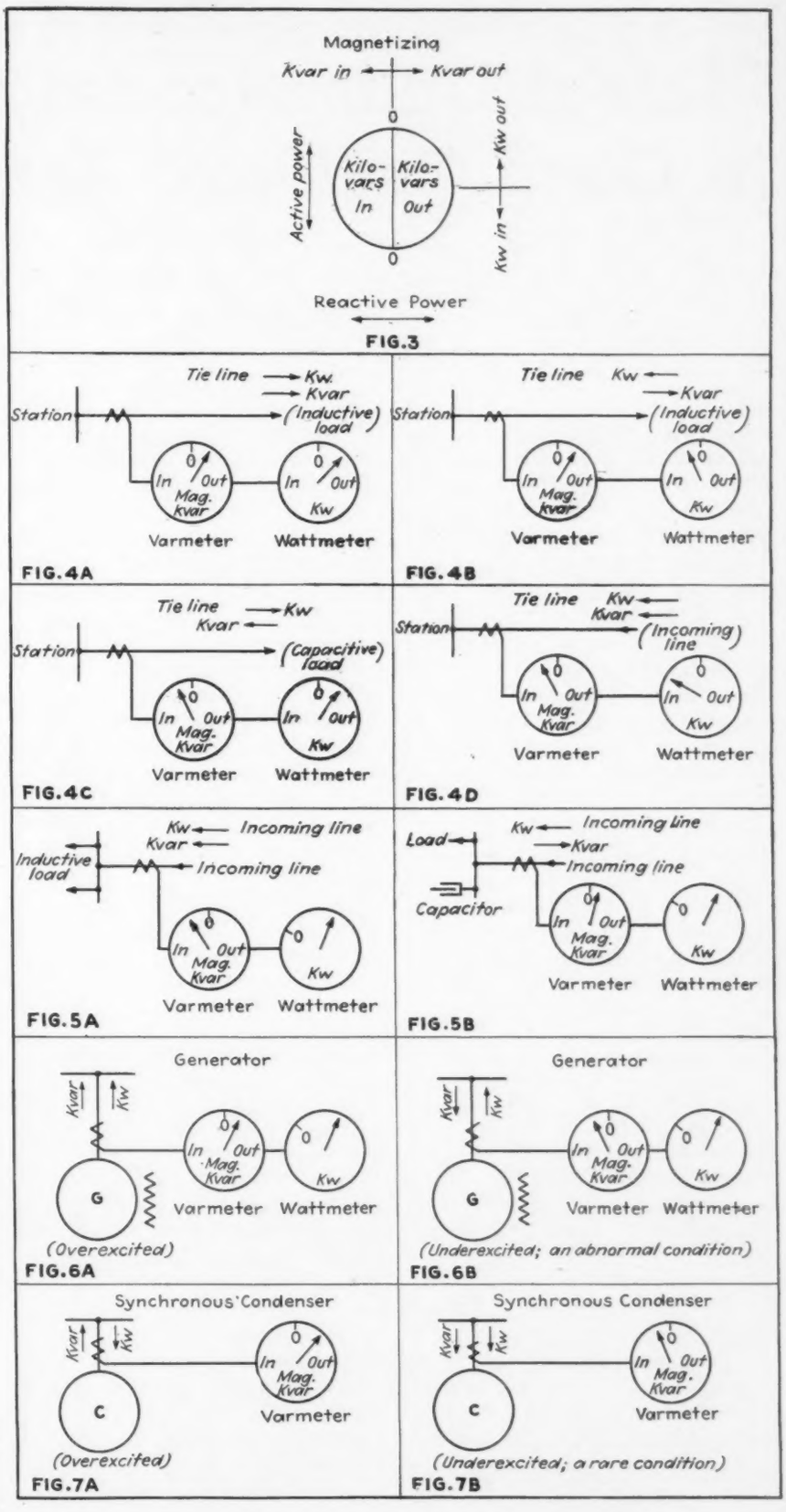
5. As applied to tie lines, comparison of the wattmeter and varmeter readings will show at a glance whether, and to what extent, the necessary magnetizing reactive power is being furnished in the same direction as the kilowatt power flow, as usually desired.

6. Because the scale (Fig. 1) is so marked, it is clear that this instrument measures *magnetizing* (inductive) reactive power, and not capacitive reactive power.

Direct, Not Ratio

Examples of the new scale marking are shown in Figs. 4A to 7B inclusive.

It is hoped that varmeters will now find increasing use as an aid to efficient power system operation. A power-factor meter shows only a ratio between two quantities and in the neighborhood of unity power factor even small changes in this ratio represent very substantial changes in the reactive power flow and hence in the excitation of the connected synchronous machinery. In contrast to this, a varmeter gives, in one instrument, as complete information regarding the reactive power flow as a wattmeter does regarding the active power flow.



TIE LINE, generator and synchronous condenser performance more readily appreciated by treating all reactive flow as magnetizing in an appropriate direction

Mutual Understanding Basic in Good Customer Relations

Public Service of Oklahoma informs employees at weekly meetings of salient facts on company operations — Formulates customer service program and goes into field for 10,000 customer interviews

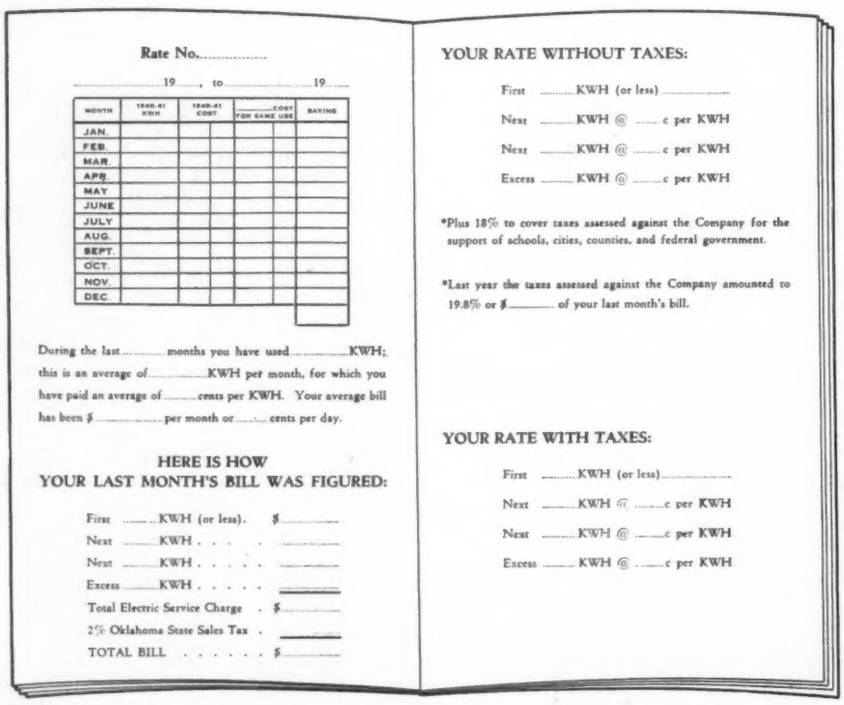
R. K. LANE, President, Public Service Company of Oklahoma

THE SUCCESS of a utility company in maintaining friendly relations with customers depends in a great measure upon the customer's understanding and knowledge of the company's problems and the nature of the electric utility business, but it also depends upon employees' ability to understand the customers' attitude and accept a responsibility in this regard.

Many ways have been used by utility companies to furnish their customers with information about the electric utility business, such as institutional advertising, bill stuffers, talks before groups and information given individual customers by employees. However, there is no more effective way of disseminating this information than through the personal interview between a well-trained employee and the customer.

If all the customers of a utility company had personal contacts with well-trained employees the problem would be relatively simple. Despite the efforts of utility employees, the larger percentage of their customers are still beyond the circle of their contacts.

The approach made by the Public Service Company of Oklahoma to this problem has been twofold.



Rate No.....

.....19....., to.....19.....

MONTH	1940-41 KWH	1940-41 COST	..... COST FOR SAME USE		SAVING
JAN.					
FEB.					
MAR.					
APR.					
MAY					
JUNE					
JULY					
AUG.					
SEPT.					
OCT.					
NOV.					
DEC.					

During the last..... months you have used.....KWH; this is an average of.....KWH per month, for which you have paid an average of.....cents per KWH. Your average bill has been $.....per month or.....cents per day.

HERE IS HOW
YOUR LAST MONTH'S BILL WAS FIGURED:

First .....KWH (or less). $.....
Next .....KWH . . . .
Next .....KWH . . . . .
Excess .....KWH . . . . .
Total Electric Service Charge . $.....
2% Oklahoma State Sales Tax .
TOTAL BILL . . . . . $.....

YOUR RATE WITHOUT TAXES:

First .....KWH (or less).....
Next .....KWH @ .....c per KWH
Next .....KWH @ .....c per KWH
Excess .....KWH @ .....c per KWH

*Plus 18% to cover taxes assessed against the Company for the support of schools, cities, counties, and federal government.

*Last year the taxes assessed against the Company amounted to 19.8% or $..... of your last month's bill.

YOUR RATE WITH TAXES:

First .....KWH (or less).....
Next .....KWH @ .....c per KWH
Next .....KWH @ .....c per KWH
Excess .....KWH @ .....c per KWH

PAGES 2 and 3 of "An Analysis of Your Electric Service Bill," which is prepared from billing records before employee calls on customer

First—We created an employee information service for the purpose of informing all employees about their company. Since 1939 all employees have met in discussion groups one hour each week to study carefully prepared material about their company, including information on its financial aspects, value of physical property, funded debt, preferred and common stocks, earnings, local taxes, payrolls, local expenditures, etc.

Customer Service Program

The results of this training have been most encouraging. Most outstanding is the greater appreciation for the fellow employee's job and the part he plays in furnishing good utility service.

Ability to render good service depends upon knowledge of the job and the ability to make good contacts. In analyzing our contacts with our customers we found certain very definite mistakes were being made with these contacts:

1. Too little time was given to the contact.
2. Too often, customers were suppressed rather than satisfied.
3. A tendency to attempt solution of a customer's problem was too frequently made without the actual facts which could have been gained from an investigation.
4. Because complaints follow a routine pattern, they too often were handled by a routine procedure which the customer recognized and did not appreciate.

Second—In an effort to improve customer understanding and to provide a method for keeping constantly in touch with public opinion—to fos-

ter the elimination of policies or practices that produce customer annoyance, the company inaugurated a customer service program.

A training course was designed which emphasized the sales approach to the solution of customer problems. Employees were taken on field trips to power plants, substations, transmission lines and other units of physical property to vitalize much of the information previously gained in the employee information service.

Customer benefits were stressed to enable each employee to appreciate the facilities needed to furnish good service.

Forum

A forum on customer questions permitted each employee to demonstrate his ability to handle these questions. Questions covered all phases of the business and were actual questions as phrased by the customer.

Special training in conducting a customer interview with actual test interviews were a part of the course. Upon completion of the training, members of each class made a number of interviews with customers and a class review of these contacts was held.

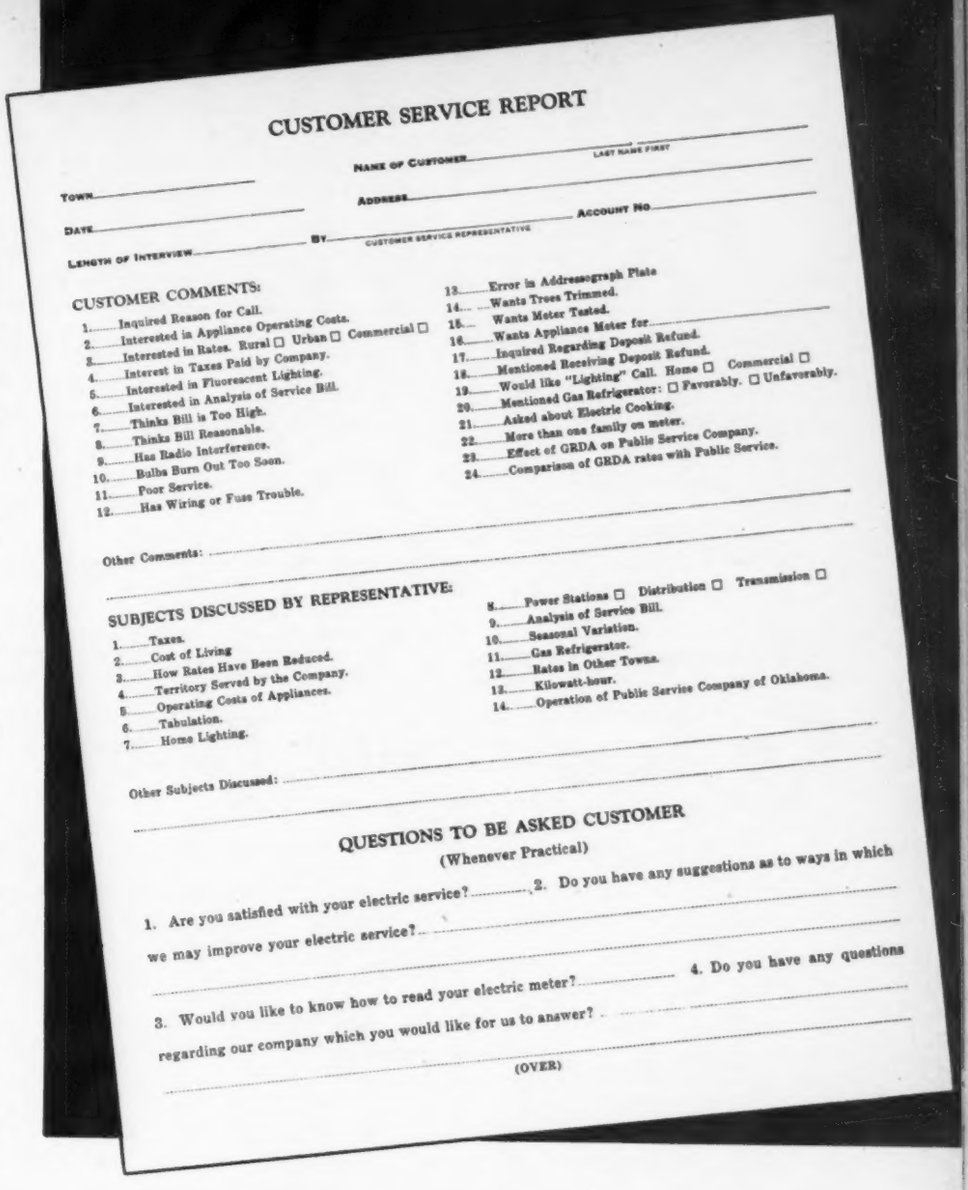
Forty employees have taken customers' service training. Ten employees were selected from this group to become customer service representatives. These representatives handle all customer complaints, other than those which can be satisfactorily handled in the office or over the telephone.

In addition, unsolicited calls are made on selected groups of customers representing a cross-section of the public the company serves.

In the instance of the unsolicited call, the representative prepares an analysis of the customer's billing for the previous year and discusses with the customer matters pertaining to the customer's use of the service, which are of interest to the customer.

Each representative is supplied with a sales manual containing information about appliance operating costs, rates, service information, meter information and general information about the company.

Approximately 10,000 calls have been made on our approximately 63,000 domestic customers and some very interesting information has been obtained.



CUSTOMER SERVICE REPORT

NAME OF CUSTOMER _____ LAST NAME FIRST

TOWN _____ ADDRESS _____

DATE _____ ACCOUNT NO _____

LENGTH OF INTERVIEW _____ BY _____ CUSTOMER SERVICE REPRESENTATIVE

CUSTOMER COMMENTS:

1. Inquired Reason for Call.
2. Interested in Appliance Operating Costs.
3. Interested in Rates. Rural ☐ Urban ☐ Commercial ☐
4. Interest in Taxes Paid by Company.
5. Interested in Fluorescent Lighting.
6. Interested in Analysis of Service Bill.
7. Thinks Bill is Too High.
8. Thinks Bill Reasonable.
9. Has Radio Interference.
10. Bulbs Burn Out Too Soon.
11. Poor Service.
12. Has Wiring or Fuse Trouble.
13. Error in Addressograph Plate
14. Wants Trees Trimmed.
15. Wants Meter Tested.
16. Wants Appliance Meter for _____
17. Inquired Regarding Deposit Refund.
18. Mentioned Receiving Deposit Refund.
19. Would like "Lighting" Call. Home ☐ Commercial ☐
20. Mentioned Gas Refrigerator: ☐ Favorably. ☐ Unfavorably.
21. Asked about Electric Cooking.
22. More than one family on meter.
23. Effect of GRDA on Public Service Company.
24. Comparison of GRDA rates with Public Service.

Other Comments: _____

SUBJECTS DISCUSSED BY REPRESENTATIVE:

1. Taxes.
2. Cost of Living
3. How Rates Have Been Reduced.
4. Territory Served by the Company.
5. Operating Costs of Appliances.
6. Tabulation.
7. Home Lighting.
8. Power Stations ☐ Distribution ☐ Transmission ☐
9. Analysis of Service Bill.
10. Seasonal Variation.
11. Gas Refrigerator.
12. Rates in Other Towns.
13. Kilowatt-hour.
14. Operation of Public Service Company of Oklahoma.

Other Subjects Discussed: _____

QUESTIONS TO BE ASKED CUSTOMER

(Whenever Practical)

1. Are you satisfied with your electric service? 2. Do you have any suggestions as to ways in which we may improve your electric service?

3. Would you like to know how to read your electric meter? 4. Do you have any questions regarding our company which you would like for us to answer?

(OVER)

CUSTOMER SERVICE REPORT used by regular customer service representative to insure proper coverage of topics and provide facts for guidance of management

Our first concern was the reaction of the customers to unsolicited calls. Seventeen percent of the customers inquired as to the reason for the call. However, only 38 customers indicated that they were not interested in the interview.

As to the general attitude, we found 74 percent of our customers who mentioned that they were well satisfied with the service our company is furnishing. One percent indicated they were dissatisfied with our service.

We found customers to be most interested in appliance operating costs. Forty-nine and eight-tenths percent of the calls resulted in discussion of these costs. Rates were a close second in interest as 46.8 percent entered into a discussion of rates. Customers who were interested in how to read their electric meters formed 21.9 percent of the total interviewed.

The amount of taxes paid by our company interested 19.7 percent of those called upon. It is well to state that the customer is allowed to direct the nature of the interview and no attempt is made to make a set speech regarding information we think the customer should know.

It is significant that though 29.8 percent felt their service bills were too high, 30.1 percent indicated they thought their bills were very reasonable. Meters were tested for 20 percent of those registering high bill complaints; the others were satisfied after an analysis of the service bill was made.

The faulty operation of appliances was accountable for 13 percent of our high bill complaints. In the final analysis, although classified as "high

bill complaints," the underlying reason for a majority of these complaints was the customer's financial inadequacy.

Service complaints made up a total of 9.2 percent of total calls. Wiring trouble on the customer's premises accounted for 54 percent of service complaints. Radio interference accounted for 17 percent. Belief that bulbs burn out too soon due to high voltage accounted for 8 percent of the service complaints.

These complaints generally were satisfactorily handled by instituting a bulb-dating program on the part of the customer, with a follow-up by the company. Company employees were responsible for 4 percent of the complaints about service. The remaining 17 percent of service complaints were due to service wires with bad insulation, trees needing trimming, and the like.

The public's attitude toward a utility company is affected materially by dissatisfaction arising from misunderstandings about the use of the service as definitely as through any actual error on the company's part. The iron that does not heat or the refrigerator that is short of refrigerant may not be the company's responsibility, but it is responsible for a good deal of customer dissatisfaction with the company.

The Public Service Company of Oklahoma feels that the inauguration of its customer service program has served to increase understanding between its representatives and its customers.

Maximum Output from Existing Boiler Plants

Avoid unscheduled outages — Watch instruments, water treatment, circulation, carryover, rate of loading, lighting-off, corrosion, pulverizers, excess air, slag formation

E. G. BAILEY, Vice-President The Babcock & Wilcox Company*

STATIONS now operating must supply nearly all of the power needed to see us through this war. Power plants formerly operating with comfortable capacity factors probably will be stepped up close to, or beyond, the 100 percent mark. This means intelligent inspection, repair and operation.

Nothing decreases output so seriously as emergency or unscheduled outage. Observations indicate that as stations become more heavily loaded the likelihood of forced outages becomes greater. This need not necessarily be true; in fact, it does not happen that way in all stations.

Tube Failures, Leaks

Many important things take place within the pressure system of the steam-generating unit in a power plant which cannot be seen while operating. There are numerous meters and instruments available to visualize and record many important factors which formerly were entirely unknown, such as steam output, draft loss, conductivity of boiler water indicating concentration, etc. None, however, can definitely indicate scale formation, corrosion and many other conditions which can only be determined by periodic internal inspection.

The most frequent forced outages of boiler units are those due to tube failures or leaks at tube seats or handhole fittings. Some of the more frequent causes for such failures are:

1. Improper feedwater treatment, with resultant scale or sludge, causing overheating of tubes.
2. Faulty boiler or water-wall circulation.
3. Priming or carryover to superheater and turbine.
4. Leaks due to thermal stresses resulting from too rapid temperature changes.
5. Corrosion or tube wastage, internal or external.
6. Cutting of tubes by soot blowers.
7. Low water.

Feedwater treatment—Progress in feedwater treatment to prevent tube losses has been very real in comparison with the extensive scale formation in low-pressure boilers of former years. Many plants now operate for years without losing a single tube, and some even without any internal cleaning. This accomplishment is of untold value when one considers the greater difficulty in preventing scale with modern boilers operated at higher pressures and rates of heat input. Yet today there are still more outages for tube losses and for cleaning scale and sludge from boilers than from any other one cause. With the urge to keep boilers operating at higher outputs and for longer periods between scheduled outages for inspection and cleaning, forced outages due to inadequate feedwater treatment are likely to increase.

Causes of Losses

Some of the causes for tube losses resulting from imperfect feedwater treatment are listed as follows:

(a) Overconfidence that feedwater treatment is entirely satisfactory because of many months or even years

* Condensation of paper at Midwest Power Conference, Chicago, April 9, 1942.

of satisfactory operation with no tube losses. However, the cumulative effect of anything short of 100 percent will ultimately lead to tube losses unless vigilant inspection and remedy correct the situation in time.

(b) A sudden change in water conditions due to condenser leakage, effect of dry weather on supply, or one of many other causes, with the difficulty of promptly changing the treatment in the exact degree required.

(c) Carelessness or ignorance in treatment.

(d) Divided responsibility, where a consultant is held responsible, and yet dependent upon the accuracy and conscientious daily and hourly checks of those in the operating force who must carry out the details of the method. Sometimes even the prescription is not entirely correct. Another phase of divided responsibility arises when inadequate boiler circulation is injected into the problem as being the cause for tube failures. This may or may not be justifiable.

Some operating companies have thoroughly competent chemists and laboratory facilities for satisfactory feedwater analysis and treatment, with perhaps occasional consulting service from one of the several experts in this field. The majority of operating companies employ consultants on a yearly basis with very good results. The best talent is none too good for this all-important part of boiler operation, and eternal vigilance must be exercised daily and hourly—and continuously.

Faulty Circulation

There has been and still is some faulty or inadequate circulation in some types of boilers and in some arrangements of water walls. The later units of all manufacturers are more nearly, if not entirely, free from this fault, as experience has been effective in improving the design. Circulation has often been erroneously accused of tube losses that were due to scale or sludge. It is now believed that many changes to amplify circulation were unjustifiably demanded by operators. In any event, the tendency has been to bring about ample or even a surplus of circulation.

There is no need to deny, however, that there are boilers in operation today, mostly of the older vintage, that have limitations in circulation which prevent an increase in output beyond the point where the boiler can be operated reliably and free from the liability of emergency outages. The manufacturer should be consulted about increasing the output of such boilers beyond that at which they have been normally and continuously operating, and he will undoubtedly be glad to give his present-day advice as to whether the desired rating can be obtained or suggest the change necessary to increase the output by some appreciable amount. Increased output has been obtained by changing some units at a very reasonable cost.

Priming or Carryover to Superheater and Turbine—Many older boilers are limited in output because of high moisture or carryover with the steam. This may cause deposits in and loss of superheater tubes, or, if carried on to the turbine, reduction in output or loss of time for washing or cleaning, depending upon the nature of deposits.

Great progress has been made in steam separation and often this new equipment is adaptable to installation in existing boilers to very good advantage.

Leaks Due to Thermal Stresses—Boiler outage is sometimes occasioned by leaks due to thermal stresses from too rapid temperature changes, especially with the higher pressure units having relatively thick drums, headers, tubes, etc. The best remedy is a proper schedule for bringing boilers on and off the line, guarding against slugs of water through superheaters, water hammer in economizers, etc. Sometimes seal-welding of tubes at seats and other adaptations of modern boiler-construction practice are justifiable.

Corrosion or Tube Wastage—Although internal corrosion may at first be considered a simple problem of feedwater treatment, it may be more insidious and serious than that. Some tubes have been seriously corroded in local areas most difficult to find until failure, sometimes violent, took place. The presence of copper, or other unusual factors, may be contributory to this trouble. There is still an occasional plant where the feedwater is not heated to 212 deg. F. and deaerated, with the result that corrosion or pitting takes place.

External wastage has been encountered in a few furnace-wall tubes during the past seven or eight years, but only recently has it taken place to a serious degree. While the entire cause and remedy have not yet been found, the wastage seems to be restricted to bare tubes in zones in proximity to flame from burners where there is complete or almost complete absence of oxygen in the furnace gases at the area of attack. Furnace tubes in such areas should be carefully inspected, and if any wastage has taken place steps should be immediately taken to stop further wastage, else tube losses will occur and serious outage ensue. High outputs and scale or sludge in the tubes seem to accelerate such outside wastage of tubes.

Cutting of Tubes by Soot Blowers—Occasionally, jets of steam from soot blowers cut tubes in boilers, superheaters and economizes, causing boiler outage. Blowers should be properly installed initially to forestall such cutting, but inspection at each opportunity is the surest prevention, as incipient cutting or polishing of tubes can be detected and remedied well in advance of any failure.

Fuel Burning

There are perhaps as many, if not more, factors affecting reliability, output and efficiency in the fuel end of a steam generator than in the pressure parts covered in the preceding part of this paper. Experience has indicated that the fuel problems result in less total outage, but they may account for more reduction in output than those having to do with pressure parts of this boiler unit.

Many operators may encounter more new problems and need more help on fuel than on feedwater and the boiler itself, because many have already changed, or will have to change, from gas or oil to coal. Others may have to change from their present coal supply to a new or a variable coal supply, which may not be so good. Those having to use a variety of kinds of coal should follow its analysis closely and perhaps accomplish some surprisingly good results by properly mixing or blending such supplies.

Furnace Explosions—A little carelessness in lighting a furnace may cause serious damage to life and property, and a long and expensive boiler or plant outage. While this may seem just as elementary as low water,

I make no apologies for emphasizing furnace explosions, because they still occur more often than seems excusable, with real disaster. The frequency and damage are greatest with gas and oil. Next comes pulverized coal. Here the trouble is often with the gas or oil lighting-torch system, but occasionally arises from the coal itself. Explosions seldom occur in stoker or hand-fired boiler furnaces, although occasionally gas is generated in such quantities that dead pockets form and become ignited.

Electric eyes, interlocks and protective devices are rapidly being perfected to a high degree of reliability and usefulness in this particular. With or without them, intelligent carefulness is needed at all times.

Stokers—Stokers need maintenance. The best way to attain the maximum output and prevent unscheduled outage due to breakdown or burned-out parts is to inspect and repair as needed. Uniform firing prolongs the life of stoker grates and tuyères.

Pulverizers and Feeders

Pulverizers perform a real job of mechanical attrition on coal. The coal, pyrites, and tramp iron, in turn, subject the feeder and pulverizer to considerable wear. The first step toward maximum output and reliability of this equipment is to keep tramp iron, wood and other foreign matter, as well as oversized coal, out of the feeder. Crushers should be kept in good condition, and preferably used on all coal over $\frac{3}{4}$-in. screen.

The pulverizer wearing parts must be periodically and properly adjusted and replaced. Shortage of certain alloys may result in the need to use materials having shorter life, and therefore more checking and replacements. Machinery of this kind needs proper lubrication and adjustment of bearings and gears.

Fans, Blowers and Exhausters—Little need be said beyond the need for periodic check on wear of exhausters by coal and perhaps on induced-draft fans by fly ash and cinders. Some fans have been neglected to the point where they flew to pieces and caused a long and expensive outage.

Pulverized-Coal Piping and Burners—Any pipe carrying coal in raw or pulverized form is subject to some wear, especially at bends. Such points should be systematically watched and repaired. Fine pulverization reduces the rate of wear.

Ashes, Clinker, Slag, Cleaning and Removal—Not every one fully realizes how much progress has been made in perfecting designs of steam-generating units to burn successfully the low grade coals. Many plant operators will probably be well repaid during the next few years for their foresight in selecting equipment of the advanced designs.

Fuel Beds

There are many installations of the older or more limited design where difficult problems will be faced from ash and slag as ratings are increased or coal of less adaptable characteristics must be burned.

In fuel beds, much trouble from clinker can be avoided by maintaining uniform and relatively thin fuel beds with equalized distribution of the correct amount of air. Zones of excessive reducing condition, which result in more fluid and troublesome clinker, especially with coal ash higher in iron, should be avoided.

Pulverized-coal-fired furnaces perform better in every way when the coal is finely pulverized and mixed uniformly with the correct amount of air. Fine pulverization cannot be stressed too strongly, especially with respect to the 50-mesh size. It pays to check each pulverizer regularly with fineness tests.

Combustion Air

Proper distribution of coal and air at burners and in the furnace should be checked by weighed coal collections at burner, and by analyzing gases of combustion in the furnace from near the burners on through the furnace and boiler. This requires suitable water-cooled gas-sampling tubes and gas-analyzing equipment for oxygen and CO in addition to the usual CO_2 determination.

Slag and Excess Air—Much has rerently been learned about the effect of excess air on slag conditions throughout a furnace and boiler unit. Excess air affects furnace temperatures, as well as the fusing temperature of the slag and fly ash. Higher excess air actually results in the ash and slag collected on the walls and tube banks being of a higher fusing temperature than if the excess air were lower. This means that the actual slag and ash accumulation in many furnace walls and tube banks is higher by 100 to 400 F. than the usual laboratory standard determination, which is done in a reducing atmosphere, while in zones of low excess air the slag fusing temperature may be as low as the laboratory results, or even lower due to a segregation which causes the iron content to be greater than the average. The higher the iron content of the ash the greater are these effects, which result largely from the differences in the oxides of iron.

Even after taking all precautions possible there still will likely be slag-cleaning problems to face. Many recent boiler units are so arranged that a reasonable number of retractable blowers keep the unit in a satisfactory degree of cleanliness with the expenditure of very few man-hours. More hand lancing may be needed throughout all parts of some boiler units if high temperature alloys needed for soot and slag blowers are greatly restricted.

Slag Formation

Outages of slag-tap furnaces are occasionally caused by slag leaks, or leaks of the water-cooling tubes around the tap hole. Slag leaks usually result from the erosive nature of molten iron-sulfide when it accumulates on the floor underneath the regular slag. This sulfide, and sometimes metallic iron, are the result of coarse pulverizing, deficiency of air, or maldistribution from burners. Some types of floor construction are better safeguards against leaks than others, but in many cases the leaks are caused by insufficient care being given to construction details at corners.

Superheat control is greatly affected by excess air, and sometimes the proportion of surfaces or their relative cleanliness brings about an operating condition where efficiency is sacrificed for the benefit of superheat and vice versa.

Most plants have meters and instruments, and many have automatic control. For the best results all of this equipment must be systematically checked, and adjusted if necessary. Often this equipment is of great value in keeping conditions correct for maximum output as well as best efficiency, and is also assurance against serious accidents due to the failure of pumps, fans or other major equipment.

Conservation Theme of Appliance Repair Plan

New Orleans Public Service, Inc., introduces appliance repair program for dealers to conserve material for defense, help dealers build revenue

CONSERVATION, according to Webster—"keeping in a safe or entire state, preserving" is the essence of a new Certified Appliance Repair Shop program for electric dealers, introduced in New Orleans last September by the New Orleans Public Service, Inc.

This plan, in which 22 electric appliance dealers are cooperating, has three objectives directly related to conservation:

1. *Conservation for Material*—Materials normally used each year in manufacture of new appliances are released for war production through repair of used appliances.
2. *Conservation of Dealers' Profits*—Repair business offers electrical dealers extra profits, a new and needed service at a time when merchandise sales are dropping off.
3. *Conservation of Comfort*—Repair of neglected time—and work-saving appliances release the owner's time to leisure and wartime pursuits.

Beyond this, the plan offers a medium for publicizing to customers the need for maintaining their "old" appliances as a wartime measure. It would be unfortunate if, through lack of warning, customers discarded usable appliances only to find themselves unable to replace them with new.

Details of Plan

The New Orleans certification plan was *offered* to all electric appliance dealers in the New Orleans Public Service, Inc., territory. *Certification* under the plan, however, was restricted to dealers capable of conforming to certain service standards and guarantees. Authorization to display the official Certified Electrical Appliance Repair Shop seal hinged upon several conditions. The dealer must:

1. Have an established place of business where appliance repairs are made; have at least one employee on duty from 8:30 a.m. to 5 p.m. to receive and deliver appliances.
2. Be capable of making repairs to practically all types of electrical appliances.
3. Stock appliance repair parts so that repairs may be made promptly.
4. Be equipped to call for appliances needing repairs.
5. It is suggested that all appliances repaired to be guaranteed for a period of 90 days.
6. Application for certification must be made by letter or form to the New Orleans Public Service, Inc.
7. Dealers must agree to serve as a Certified Appliance Repair Shop for one year.
8. Dealers must repair appliances at reasonable prices, consistent with earning a fair profit.

On application the dealer accepts the responsibility of efficient workmanship, reasonable prices, high-grade parts, courteous treatment and swift service and assumes full responsibility for all repairs made. He also authorizes the utility to advertise that he will guarantee the service points enumerated.

Results

At the outset 22 dealers qualified under the plan. Several have since been added. It is notable that at the end of the first three months of operation *all* of the original 22 dealers reported an *increase* in repair business and were enthusiastic in their support of the plan. No actual data are available on the increase in repair business; however, all dealers characterized it as "fair." With varying numbers of dealers reporting different items the appliances repaired by deal-

C. J. MASSA, proprietor of a certified repair shop, shown at work on a toaster, reports that the appliance repair program has brought him more business

SEAL that marks every certified dealer's shop is featured in all advertising. This card appears in all street cars and buses and in dealers' stores

ers who have reported on the first three months business were as follows:

Radios	1,332	6 specialists reporting
Washers	267	4 specialists reporting
Refrigerators	300	
Lamps	114	15 dealers reporting
Irons	96	15 dealers reporting
Vacuum cleaners	23	15 dealers reporting

The supply of repair parts has not been a major problem in operation of the plan to date. Jobbers have been able to supply all dealer needs. However, steps are being taken to investigate the possibility of stripping parts from appliances taken "in trade" during past years and stored away. Exchange of extra repair parts between dealers is also being considered.

Where it is uneconomical for a jobber to deliver inexpensive repair parts to remotely located dealers the utility will deliver the parts within 24 hours if the jobber (generally in the heart of the city) will bring it to the utility's main office.

To direct attention away from its own repair service and develop repair business for the certified shops, the utility company moved its main office repair booth to the basement. While the company continued to serve customers actually bringing in appliances for repairs, customers were encouraged to use certified shops in their neighborhood. Attention was called to the fact that certified shops did guaranteed work at reasonable prices.

The residential sales force of the utility was provided with literature listing the location of certified repair shops and instructed to recommend their use. Dealers were provided with similar literature for distribution in their vicinity. Residential salesmen of the utility in some instances assist the customer and dealer by taking appliances to a designated repair shop, but the dealer is advised to return the appliance to the customer. No actual canvassing for appliances to be repaired is being done by the company.

Advertising and Promotion

A vigorous advertising and promotion of the certified repair shop program was conducted in newspaper, radio and movie screen media. In announcing the program, a total of 2,062 lines of teaser advertising was run in newspapers alone during the two months prior to the announcement. A total of 4,250 lines were run in newspapers in announcing the plan and in the eight weeks following. In addition 24 advertisements averaging fourteen column inches were run in miscellaneous publications.

Editorial releases to neighborhood newspapers where certified shops are located focused attention on the significance of the program as an aid to defense through conservation of materials. This type of promotion was backed by the use of street car and bus display cards, handbills, bill stuffers and tags for attachment to repaired appliances by both dealers and utility. In all the advertising, displays center around the three-color seal that marks the certified appliance repair shop.

Emergency Squads for Plant Protection

VOLUNTEER SQUADS who will supplement a plant's regularly organized fire, police and medical departments during air raids and other emergencies are recommended by Dr. T. Lyle Hazlett, medical director, Westinghouse Electric & Manufacturing Company, as an added precaution to insure protection of personnel, plant and equipment.

Here is the outline of such squads and their duties, as organized at Westinghouse, and reported in the *Executives Service Bulletin* of the Metropolitan Life Insurance Company:

Four Squads Organized

Four squads or subgroups will be formed within the works engineering division, care being taken to appoint those who can be released from regular duties in an emergency. These men will be assigned "standing orders" and will be given additional training.

1. *Rescue and Demolition Squad*—This squad will be headed by a construction supervisor or some one in equal capacity, and should include at least six tradesmen familiar with building construction. Its function is to release victims trapped in debris, and to perform other types of emergency work such as shoring, rigging, welding, demolition and all work necessary to keep the buildings and grounds safe after damage has been done. It should maintain, at a central station, a utility wagon equipped with hard hats for each member, a minimum of two all-service gas masks, emergency lights and an assortment of such items as picks, bars, jacks and rope.

2. *Emergency Repair Squad*—This squad takes specific responsibility for maintaining or restoring power supplies throughout the plant by means of emergency repairs, so that normal production can be maintained in all but the affected area. It should be headed by a maintenance supervisor and should include six qualified tradesmen.

3. *Salvage Squad*—This squad will follow up the plant fire brigade and perform normal fire salvage operations, removing from the fire area vital statistics, records and equipment, and placing tarpaulins and salvage sheets over larger equipment that cannot be moved. It will maintain at a central station a utility wagon equipped with tarpaulins, wrenches, rollers, bars, hatchets and emergency lights.

4. *Communications and Control Squad*—This squad is to operate the report center. It should include sufficient operators for the necessary telephones, one or more of the works engineer's staff to operate a control board, and a telephone repair group to maintain telephone communications. Runners should be in reserve if telephones fail.

The report center should be centrally located at a protected point and should be equipped with one telephone for every three wardens, supplemented by a duplicate telephone system to the local city report center. Attention should be given to emergency lighting and ventilation.

A large-scale plant layout should be available for recording any unusual conditions occurring during the emergency. This will also be used for controlling the distribution of the emergency squads. Present communication systems should be used as permanent or auxiliary communication systems.

Wardens and Observers

Under the control of the chief warden should be two groups of volunteers known as wardens and observers, who will function in the event of sabotage, espionage, propaganda and air raid. Their responsibility is to keep the report center informed of all incidents that occur within their area. Wardens should be assigned on the basis of at least one to each 300 employees, or one to each 50,000 to 75,000 sq.ft. of unobstructed floor space, or one on each floor of a multistory building.

Heading up the entire emergency organization for the plant is the plant protection chief, appointed by and reporting to the plant manager. During an emergency, the chief will be subordinate only to the plant manager.

Evaluate Steel Pipe as A.C. Conductor

Test data show steel pipe to offer desirable characteristics as substitute for copper in high-voltage substations with long spans — Original data on capacity of solid and slotted steel pipe compared to copper

STANLEY C. KILLIAN, Delta-Star Electric Company, Chicago*

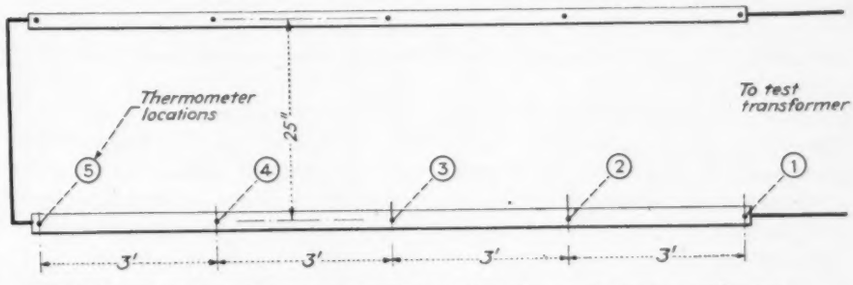
SINCE COPPER is becoming increasingly difficult to obtain and aluminum has long since been on the "must not" list, steel pipes as electrical conductors may come to the fore. While used to a limited extent, their function as a long-span, comparatively low-current bus has not been fully appreciated. On higher voltage substations, where currents are often low and long bus spans make an economical arrangement, steel pipes offer "made-to-order" characteristics.

Test Set-Up

There is very little in engineering literature dealing with a.c. capacity of steel pipe. Accordingly a full set of heat runs were undertaken, basing capacities on a 30 deg. C. rise for comparison with copper and aluminum conductor capacities. The test set-up is shown. Twelve-foot lengths of galvanized wrought steel pipe were used and assumed long enough to eliminate end effects and to give sufficiently accurate readings for a long bus.

This assumption was verified when completion of tests showed average maximum variation between thermometers 2, 3 and 4, was only 2.2 deg. C. Hot-spot temperatures were used to determine rises. Twenty-five inches between conductors was picked as an optimum dimension. Spacing could be much less without proximity effect reducing capacity, for current values are quite small. The average d.c. conductivity of pipes tested was 11.6 referred to a copper base of 100. Pipes were mounted 30 in. above the floor in a draft-free room.

* Development and research engineer.



SET-UP for testing current-carrying capacity of steel pipe used for bus conductors

Three different current tests were made on each pipe size to plot a curve on a "current-vs.-temperature-rise" graph. Points were obtained both above and below the 30 deg. C. rise value, to avoid curve extrapolation. The table shows the results of these tests with current capacities rounded off. These vary from actual test capacities by an average of only 7 amp. Outdoor values were obtained by multiplying the indoor values by a factor obtained from a rounded ratio of outdoor capacities to indoor copper capacities. National Electrical Manufacturers Association's standards for current-carrying capacity of copper pipe shown in the table were used to obtain these ratios.

Test Results

A true valuation of these test results must consider that d.c. conductivity means little. The a.c. power losses which contribute to conductor heating are d.c. resistance loss, skin effect resistance loss and hysteresis and eddy current losses. Good bus engineering avoids running a.c. conductors through ferrous loops; where steel pipe is an a.c. conductor every filament of current is surrounded with

SLOTTING of steel pipe increases capacity 26 to 52 percent, depending on size, due to reduction in hysterisis and skin effect losses

a ferrous loop, giving rise to local heating due to hysteresis and eddy current losses.

In a non-ferrous conductor skin-effect is due to the many flux linkages at center of the conductor, compared to the outside. The same effect takes place to a greater degree in steel pipe, since flux linkages in steel are much more effective. These two facts explain the greatly decreased current values for steel as compared to copper. Note also that on a copper base the $\frac{3}{4}$-in. steel pipe shows a higher percentage of conductivity (105/515) than the 4-in. pipe (370/2850). This is because of the larger section exposed to magnetic heating.

Tests were made on newly galvanized pipe and checked against plain pipe, aluminum painted, to produce about the same emissivity value. No difference in current capacities was noted. Pipes painted a shiny black showed an increase in capacity

Current-Carrying Capacities of Standard Iron Pipe Size Tubing in Amperes, 30 Deg. C. Rise, 60 Cycles

Pipe Size	Steel Pipe		Slotted Steel Pipe		Copper Pipe (NEMA)	
	Indoor	Outdoor	Indoor	Outdoor	Indoor	Outdoor
¾ in.	105	140	160	215	515	680
1 in.	125	160	180	235	675	860
1¼ in.	145	185	205	265	875	1,130
1½ in.	170	215	235	295	1,025	1,285
2 in.	210	255	280	340	1,300	1,585
2½ in.	250	300	325	390	1,700	2,010
3 in.	290	345	370	440	2,175	2,560
3½ in.	330	390	415	495	2,525	3,040
4 in.	370	435	465	550	2,850	3,400

of about 15 percent. Dull black paint showed a higher increase. Well-weathered galvanized pipe would have a current value somewhere between 100 percent and 115 percent of values shown in the table.

Slotted Pipe

Preliminary checking showed that for a given rise a steel pipe with a slot through its entire length, as shown, would carry considerably more current than a solid pipe. All pipes were slotted and again tested to determine slotted pipe capacities. Rounded results are shown in the table. Outdoor values were obtained in the manner previously stated. All gains in capacity were appreciable, varying from an increase of 26 percent for 4-in. pipe to 52 percent for ¾-in. pipe. A ⅛-in. slot was selected as an optimum width. Increasing the width of the slot to ¼ in. showed an improvement of only about 5 percent.

To be sure that magnetic phenomena and not heat transfer was responsible, slots were taped up and tests repeated. No perceptible difference was noted. It is a well-known fact that putting a slot in a ferrous loop circling an a.c. conductor will reduce heating to a very great extent. Much the same reasoning can be applied to slotted pipe. Here the conductor itself is slotted, and while a small ferrous flux path can exist around each filament of current, the slot prevents the union of all these flux circles into one large circle entirely inside the steel.

Test results shown were obtained with the slot down; most logical from a rain collection standpoint. Check tests with slots up showed little improvement due to self-ventilation. Strength tests of slotted and solid pipe showed deflections were almost identical for the ⅛-in. slot.

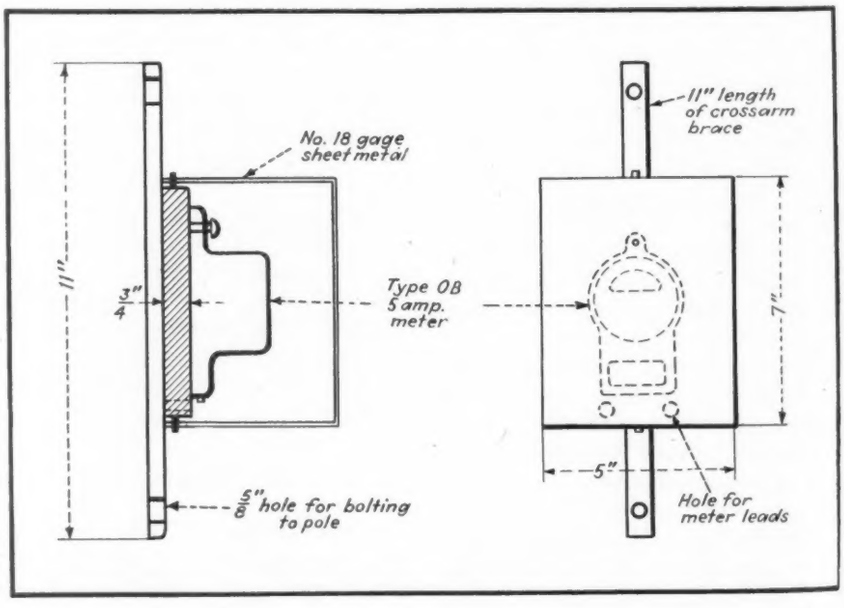
Slots can be cut very economically with flame cutters. Milled slots though practical are questionable as to cost. For a given current capacity cost of a small pipe plus slotting must be balanced against a larger unslotted pipe.

Application

In high-voltage substations larger size copper tubing is often used for long bus spans to avoid large deflections. Though smaller sections would be ample for current needs, their excessive deflections are objectionable. Often, when a large copper tube is selected to reduce the sag, current capacity of a like size steel tube would be sufficient and would effect considerable saving. For a like span and load, deflection of steel pipe is only slightly more than half that of copper. Spans can therefore be increased by approximately 20 percent and retain the same sag as the shorter copper span. Conservative design limits maximum sag to pipe diameter.

When copper or bronze fittings are used with galvanized pipe they should be coated or cadmium plated to eliminate electrolytic corrosion.

Use Old Meters to Check On Diversion



Because they are small and can be mounted in an inconspicuous metal housing, Central Illinois Electric & Gas Company, Rockford, Ill., has found that its stock of obsolete Westinghouse type OB 5-amp. meters is ideally suited to pole mounting for checking energy use where current diversion is suspected. The accompanying sketch shows the compact weatherproof inclosure in which the meters are installed for pole mounting. Meter leads are brought out through the back of the housing.

Salvage of Lighting Load from Blackout

Morale of public strengthened by Pacific Gas & Electric Company instructions to customers — Experiences with commercial and residential blackout problems

BLACKOUT is drastic on lighting load. Pacific Gas & Electric Company, whose lines extend over the coastal area of more than half of California, learned this with a jolt the night after Hawaii was raided. At 6 o'clock came the all-time system peak. One hour later a third of the system was blacked out. Orders from the Army command then shut off all electric signs and window lighting for an indefinite period.

Both as a public-spirited move to restore morale shaken by the unexpected blackout and to restore within reason the load lost the company's commercial department, under R. E. Fisher, vice-president in charge of public relations and sales, took steps to acquaint both domestic and commercial customers with authentic information for the controlled use of light under blackout conditions. Lighting sales crews were given instructions to relay to the public.

Although there have only been two blackouts since the first during normal evening hours, as a result of this program the public is well acquainted with the procedure and extensive blackout preparations have been made that permit the use of normal lighting in one or more rooms of most homes.

Since official sanction was desirable, lighting experts of the company worked closely with the blackout precautionary advisory committee of the San Francisco Chamber of Commerce. This organization called together several meetings of business and industrial operators to disseminate information contained in the official publication of OCD, "Blackouts" (see ELECTRICAL WORLD, December 6, 1941, page 7) and to present available obscuration materials. On the advisory committee the power company and Illuminating Engineering Society lighting men acted as advisers on lighting problems to local industrial plants. But the need for a more thorough canvas of domestic and commercial customers was seen.

The commercial sales forces under Joseph Gunz, manager of commercial and industrial sales, were equipped with copies of a bulletin digested from the official booklet "Blackouts" by the San Francisco Civilian Defense Council committee. They were also given instruction in a meeting at which was presented to them (1) the behavior of the eye under blackout conditions by Dr. Leland H. Brown, Stamford University, (2) obscuration methods and light control, by W. A. Cyr, *Electrical West*, (3) possible future controlled lighting fixtures for low-intensity outdoor use, by John Walsh, P. G. & E., and (4) fluorescent and luminescent materials for markers, signs, etc., by Dr. Brown.

DISPLAY of blackout materials and methods in one of the division offices for advisory service to customers

The domestic program was more extensive and called for the immediate contact of all domestic customers by the lighting sales crews and all the domestic salesmen. This phase was under Bert Reynolds, manager, domestic sales. Its purpose was (1) to impress customers that the Pacific Gas & Electric was giving a timely and helpful service, much needed and truly in the interests of morale and the war effort; (2) to point out the greater need for lighting in the home now than ever before because blackouts would cause people to stay home more, to engage in many activities such as studying, sewing, knitting, that require better lighting and that (3) home safety, despite blackouts, was an urgent necessity. The domestic salespeople also urged use of more or less permanent rather than merely temporizing methods of obscuration.

To supplement their efforts, *P. G. & E. Progress,* distributed to all domestic consumers, carried a full-page article on illumination in blackouts and advertised the availability of a booklet, "Blackout Pointers," to all customers. In the latter the do's and dont's for blacking out the home as recommended by the Blackout Precautions Advisory Committee were listed and illustrations clearly indicated simply yet sturdy methods of obscuration. A shopping list of materials was also a helpful aid. Displays of these materials and screens and draperies fashioned of them were then provided in division offices. As a result of this program, the domestic load affected by the blackouts will be confined to those customers who have not yet provided means for obscuration. This group is diminishing as the salesmen make the rounds.

The commercial problem is more complex. Some cities, wherein authority for regulations rests according to civilian defense procedure, have not yet permitted relighting of outdoor signs or store windows unless an attendant is on duty all night. However, as control devices are made available and methods worked out for switching off of store window and sign lighting satisfactory to local authorities, this load is again being picked up gradually. Hotels as yet have no alternative but to turn off lights at the main switches because guests cannot be relied upon individually to switch off lighting, and the cost of equipping all windows of large hotels with light-tight screens has proved too expensive.

Editorials

S. B. WILLIAMS, *Editor*

Effect of Suspension of Appliance Manufacture

THE MANUFACTURE of electric appliances, along with a lot of other consumable durable goods, will be suspended by May 31, and when these stocks of finished goods are used up there will not be any more for the duration. This action of WPB gives added emphasis to the necessity of showing customers how to take care of their electrical equipment so that its life may be prolonged.

It is clear that the responsibility for any such effort must be assumed by the local utility. How much assistance can be had from the dealers is open to debate, but it must seem obvious that when there no longer is enough merchandise left to pay expenses the dealer has to quit.

This brings up the subject of appliance repairs and maintenance. The effort will be made, and rightly so, to push this business through the dealers, but if the dealers are not able to weather the storm, then the utilities must be in a position to serve their customers. The necessity for making a decision may come sooner than is expected.

Utilities Urged to Lay in Large Stocks of Coal

THE QUESTION of whether or not there is going to be a sufficiency of kilowatts to meet next December's peak is now pretty much like the question of weather. But the question of a sufficiency of next winter's kilowatt-hours is something about which a lot can be done—now.

Coal supply this winter is going to be a real problem unless much larger than normal stocks are laid in before fall. Like the last war, the trouble will lie in transportation difficulties. This year the situation will be made more serious by the increased demands on rolling stock by the mounting war production and the increased demand for coal created by the fuel oil shortage. Furthermore, the transportation of coal by water offers some uncertainties.

It used to be thought that bituminous coal could not be stored safely for more than two or three months, but now ways have been found to pack the coal in such a manner as to permit its storage for much longer periods. Another problem in connection with increasing coal supplies is that of available storage space. With many companies it is going to mean securing space at some distance from the plant, and that, of course, will involve an extra handling charge. Such problems will have to be weighed against the possibility of running short.

For the next few months it will be possible to move greatly increased quantities of coal and every car shipped at that time will mean one less car to go through the bottleneck next winter. The railroads need this kind of help. The country needs it. Many utilities have already started the movement of next winter's coal to their yards. We urge those that have not yet done so to buy for shipment during the next four months all the coal that they can possibly store.

If power has to be rationed because there just aren't enough kilowatts to take care of expanding war load the public will take it good naturedly, but if there has to be rationing because a company did not lay in enough coal when it could the public won't take it meekly. This is one more opportunity that power companies have to cooperate in helping to alleviate a national situation and at the same time lay up treasures of good will at home.

A Decision on Prudence

ALTHOUGH the Massachusetts commission recently ordered a rate reduction by the Salem Electric Lighting Company on the ground that earnings justified a cut in residential and commercial tariffs, the board refused to accept the city's contention that retail customers pay disproportionate costs resulting from the sale of substantial blocks of energy to an affiliated interconnected wholesale power distributor. The city claimed that retail users pay a return on a plant too large for their requirements. The case is interesting because it involves a decision on prudence.

In 1941 Salem sold 39,862,200 kw.-hr. (39 percent of its generated output) to the Eastern Massachusetts Electric Company, which interconnects leading North Shore utilities, all these companies being tied into the New England Power and Boston Edison systems. Salem's peak was 16,000 kw.; its plant rating 27,500 kw., and largest unit 7,500 kw. The commission pointed out that while the total capacity of the plant exceeds that required by the Salem customers, these have benefited by having available a reserve generating capacity on which a fair and equitable profit has been sustained for years. At no time has Salem sold Eastern energy below fixed charges and a profit.

Thus the Salem customers gain from the operating benefits of having their local station supply a substantial load to the wholesaling company. This output contributes toward the operating economy of the Salem plant, which, while composed of relatively small units, has maintained a good record for many years. The ties with the Edison

and New England Power systems are valuable for the protection these insure local loads including important war industries. The Eastern Massachusetts interconnection was one of the pioneers in the East, stimulated by the power requirements of World War I, and even more useful in today's emergency.

There can be little reason to worry about "prudence" in the prudent investment theory when regulatory bodies apply the rule of reason to determine economic justification.

Engineers in Congress

SOME unexplainable things happen in any government, but none more so than the make-up of our present Congress. Here is a body that is considering the expenditure of billions of dollars for engineering projects, yet there is not a member of the Senate whose principal business is engineering, and but five members of the House, none of whom are listed in "Who's Who in Engineering," according to a recent compilation by B. F. Affleck. Engineers, according to this study, are at the bottom of the list. Why?

Here we are, engaged in a war that will be won or lost in the factory, where engineering will be a major factor in design and production. We are short of certain basic materials and substitutes must be found. By whom? The engineer. Our whole life is rapidly becoming more and more a problem that calls for engineering solution, and yet in our legislative halls, where moneys will be appropriated, laws passed and investigations held, the voice of the engineer is heard only as an employee or as an outsider.

And after the peace is won there will come the period of economic reconstruction, heightened and intensified as a problem because of the unbalanced production capacity in certain commodities. Will lawyers, or doctors, or real estate men be able to untangle the snarls of unemployment adjustment in some of our basic industries? As the past has shown, their only recourse is to dip further into the public treasury for make-work money.

Any satisfactory solution that does not run contrary to the well-established laws of economics must come from the engineer. He must find the new uses for metals, plastics and synthetics that will keep men employed, investment healthy and competition between them for markets constructive.

Impressive as have been the contributions of the engineer to human progress in the past, they will be small as compared to what he will be called on to do. If this be true, then he must take his place in the councils of government and his voice must be heard where the decisions are made.

Dead Right

IN A PAPER PREPARED for the recent Midwest Power Conference E. G. Bailey of Babcock & Wilcox said, in connection with recommendations on how to get maximum output from existing boiler plants:

"The human being is adept in finding or manufacturing alibis; it often condones the right to make a mistake once. But that is not good engineering and it is unpardonable under existing conditions. We have engineering publications, technical societies and meetings in various parts of the country at reasonably frequent intervals to frankly tell others of our accomplishments and sometimes, but too seldom, of our mistakes and shortcomings, so that others may benefit by avoiding these later."

He is dead right.

Pooling Ideas on War Problems

PADDY, a spicy Irish line foreman, used to correct errors of judgment and skill with the cutting remark, "If iverything wus done twice it would be dom well dun."

His sarcasm was pertinent then, but it is doubly pertinent now. Because today we haven't the time to do things twice. There's no time to go back and try again. Every move, every second counts. We've got to move on.

In the next few years, as companies and individuals, we are going to have to use our ingenuity many times. We are going to make mistakes. Pity is that in many cases we could have profited by the experience of another who tried the same idea, failed, found the answer, but kept it to himself.

A lot of time, effort and priority material will be wasted this way unless we conserve our ideas as zealously as we conserve materials. But you can't conserve an idea or experience under glass. Get it out in the open, where others can see it. Pool your ideas, turn them in, get them in circulation now, when they can help others.

ELECTRICAL WORLD will launch a cooperative venture in the exchange of information on wartime operating practices, aimed at the conservation of stringent materials and equipment, with its May 30 issue. We will start the ball rolling with a large array of "brass tack" methods that are already in use on utility systems to meet war conditions. But this is to be a cooperative venture—a give and take proposition to help the other fellow avoid the mistakes you made and put your successful methods to work—right now.

So, if you made a better "mousetrap" (or fixed up an old one) don't wait for the world to beat a path to your door—sketch it out—send it in. No one can afford to do things twice in wartime.

"If iverything was done twice it would be dom well dun." Yes, Paddy, it surely would—and much, much too late to do any good.

Washington Comment

By GEORGE E. DOYING, Jr., Washington Correspondent

Utilities to Get Minimum Copper Requirements

SIX MONTHS AGO when Donald Nelson suggested using some of the government's silver cache for busbars as a substitute for copper, the scheme was indulgently labeled technically sound but economically a bit bizarre —and conveniently forgotten.

Now, it is being rushed into the breach—40,000 tons of silver bullion are being "loaned" by the Treasury to the Defense Plant Corporation and perhaps others for electrical conductor jobs in new aluminum, magnesium and similar plants for which there simply is no copper that is not required for even more urgent uses.

The changed fortunes of Nelson's unorthodox idea in just a few weeks' time illustrates perhaps more vividly than anything else could the really urgent shortage of copper which now exists. War Production Board officials take the position that the critical nature of this shortage cannot be overestimated, nor overemphasized.

Military Requirements

For instance, in the current April-June quarter, copper requirements for direct military and lend-lease production schedules virtually equal the total supply of new metal and scrap which will be available.

For all of 1942 the copper required just for these same military production schedules amounts to more than 90 percent of the maximum potential supply of newly mined metal (which will be at a record high), leaving little more than the scrap supply for all other uses.

These are not haphazard estimates, nor do they reflect the eyes-are-bigger-than-stomach error of many past raw materials requirements lists. The whole copper picture has been carefully reviewed in the last month before the WPB Requirements Committee, which is the final arbiter of general policy on distribution of raw materials among competing demands. The "water" has been squeezed out of the individual components of the copper demand table.

There's a matter of definition involved in a complete understanding of the situation—which, unfortunately, cannot be given the clarity of actual tonnage figures. In a workaday language of the war agencies in Washington, "direct military" means only the weapons of war—shells, ships, tanks, guns, planes and other accessories of the Army and Navy, the other allied governments, and of the Maritime Commission.

All other requirements are officially defined as "civilian"—of which there are two categories, essential and non-essential.

In the "essential" bracket fall such obviously urgent war items as the materials used in building new aluminum, magnesium and synthetic rubber plants, utilities' maintenance, construction of electric lines to new war plants, railroad operations, etc. "Non-essential civilian" is best described by the list of durable goods items, production of which WPB has been ordering halted right and left, until now practically that entire segment of American manufacturing industry either is dormant or will be in a few weeks.

Diverted Use

What isn't catalogued "essential civilian" in Washington these days just isn't in the market for copper, or, for that matter, any other metal and a good many other commodities.

Obviously trading in these somewhat artificial definitions, coupled with the lack of specific tonnage data, is likely to lead to confusing misinterpretations. For example, WPB announced officially last week that some copper is deliberately being diverted to essential civilian uses even at the expense of military production.

Literally, it is probably true that diversion of copper in April, May and June even to "essential civilian" uses will slow the military production schedule some, because huge new brass shell mills now are getting into production at the same time that they are building inventories. Actually, however, this copper isn't really going to get into any non-war channel. Without utility and railroad maintenance existing production couldn't be maintained; without materials for new plants projected production increases could never be reached.

What that diversion of copper from military uses, ordered by the Requirements Committee, means is that there will be a modest amount of copper allocated during April, May and June for manufacture of items such as those utilities buy on P-46 orders for repair and maintenance.

Supply for Utilities

The copper to be allotted for fabricating utility items isn't much, hardly half as much as utilities are permitted to use under the Section F withdrawal provision of P-46. In other words, only enough copper is being made available to fabricate half the volume of new supplies that utilities may withdraw from inventories—their own and their suppliers.

What copper is being diverted for new fabrication is no more than is considered the absolute minimum necessary to keep essential civilian services functioning—functioning for the war effort without interruptions, but not necessarily that well for the civilian population. But without the Requirements Committee intervention there would have been no copper available for such fabrication before summer.

For copper, then, the outlook is that utilities—even for the most essential of their repair and maintenance and new construction—are going to have to live partially on their own and their suppliers' inventory "fat" during 1942, using equipment fabricated last year before the priorities famine became acute.

NEWS OF THE WEEK

WPB Asks Utilities To Share Inventories

Power Branch asks for detailed report by May 1 on utility holdings of equipment which could be shared with other utilities — Requisition may be alternative

Utilities are being asked by the War Production Board Power Branch to share their inventories "to the last bone" with other utilities whose need for particular materials may be greater in terms of the war effort. Alternative may be requisitioning of frozen utility stocks by another branch of WPB for military use or for reduction to scrap.

Detailed Reports Asked

In letters being sent to all utilities, the Power Branch is asking for a detailed report by May 1 of all materials now in possession of utilities which exceed a practical minimum working inventory as defined in Order P-46, or which, although within those limits, could be released for war use elsewhere. Data are being sought on wire and cable, busbar shapes, power and distribution transformers, boilers, turbines and generators, auxiliary power plant equipment and spare parts, rotary converters, motor-generator sets, synchronous condensers, oil circuit breakers and motors.

The letters urge that utilities make separate lists of their holdings of each type of equipment sought, sending in each list as it is finished rather than waiting to complete them all. The lists are to be mailed to the Federal Power Commission, which has agreed to tabulate and assemble the data for the Power Branch.

It is intended that a catalog of listed materials will be prepared for distribution among utilities and suppliers to help effect the maximum possible redistribution of equipment needed for maintaining service to war industries. The Power Branch intends to act only as the "broker" between companies with material they can spare and those with urgent needs which cannot be filled because of raw material shortages.

Liberal Listings Urged

Power Branch officials characterize the drive as a mobilization of materials not now in use or needed for imminent use. They urge that utilities be as liberal as possible in listing equipment which they can afford to trade, regardless of the technical permission as to size of inventory in P-46. In this connection, it is pointed out that utilities

WAR PLANT DISTRIBUTION—Two hundred of the leading electrical engineers of southern Michigan attended the recent joint meeting of the Industrial Electrical Engineering Society and the Industrial Power Applications Group of the Michigan Section, American Institute of Electrical Engineers, held at the Detroit plant of the United States Rubber Co. These speakers described, discussed and commented on types of electrical distribution systems adopted for war plants: Back row (left to right)—George Bagley, Chrysler Corp.; H. Truesdale, Kelsey Hayes Wheel Co.; George Chute, General Electric; C. Messinger, Revere Copper & Brass Co.; Dale Douglas, Chevrolet Motor Co.; W. T. Latham, Consumers Power Co.; L. Clark, Detroit Edison Co.; Ben Clark, Plymouth Motor Co.; M. Horn, I-T-E Circuit Breaker Co., and T. Duffy, U. S. Rubber Co. Front row (left to right)—E. L. Bailey, Chrysler Corp.; L. Bogardus, Packard Motor Co.; George Owens, Briggs Mfg. Co.; James Bishop, Ford Motor Co.; Kurt John, U. S. Rubber Co.; Art Shimmin, Rotary Electric Steel Co.; J. J. Orr, U. S. Rubber Co.

may dispose of materials, either to other utilities or by returning them to suppliers, without charging the transaction to withdrawals under Section F of P-46.

This materials mobilization stems directly from the acute shortage of copper for continuing anything like normal fabrication of even the essential supplies for maintaining service and meeting new loads imposed by the war effort (see page 72, this issue). Because of this dire shortage of copper and other materials WPB has created an Inventory and Requisitioning Branch, which is empowered to offer to purchase, then requisition if necessary, stocks of materials held by any one, and to turn these stocks over to the military, hold them in stockpile or reduce them to scrap. This unit has agreed not to act in the utility field until the Power Branch has attempted its inventory redistribution plan.

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"Buy Coal" Warning Applies to Utilities

The voice of Leon Henderson, price, rationing and civilian supply director in the war hierarchy, was added this week to the list of government officials urging industry and household consumers to buy next winter's coal now.

The advice to buy coal now may develop into a "now or never" appeal for many coal users, Henderson warned. "Transportation now is available . . . but by fall our rail and truck lines will be loaded to capacity hauling war shipments."

While Henderson's remarks obviously were directed specifically at home users, they apply equally to utilities and industrial buyers. In this connection it is known that the Power Branch of War Production Board considers six months as a "fair minimum" of reserve coal supply for utilities to shoot for. Utilities may find that waterborne coal deliveries are disrupted, while rail deliveries next fall and winter will be competing with record-breaking war shipments.

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I.E.S. Issues New Edition of Industrial Lighting Code

Principles of good plant lighting are emphasized in "American Recommended Practice of Industrial Lighting," prepared under the sponsorship of the Illuminating Engineering Society and approved by the American Standards Association.

The booklet is the newest edition of the "Code of Lighting: Factories, Mills and Other Work Places," which had been previously revised in 1930. Copies are obtainable from the I.E.S., 51 Madison Avenue, New York, N. Y., at 25 cents the copy.

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Utility Will Cancel Contract with Army

Relinquishment of the contract to serve the 35,000-man Camp Gruber cantonment near Muskogee, Okla., "if it will be of any advantage to the war effort," has been agreed to by the Oklahoma Gas & Electric Co., according to George A. Davis, president.

An exchange of correspondence between Mr. Davis and Lieut. Col. H. A. Montgomery, made public by Mr. Davis, revealed that Oklahoma Gas & Electric will be reimbursed for expenses it has already incurred on the contract, and that the Grand River Dam project, tax-exempt federal hydro-electric power plant on Grand River in Oklahoma, will now be given the contract.

Cancellation of the contract followed protests in Washington by Representative Jack Nichols, Democrat, Oklahoma, who contended that GRDA should serve the camp because of its lower bid.

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Operating Companies Council Elects Officers

At a meeting of the Committee of the Council of Electric Operating Companies last week the official organization was completed with the election of William Wood, Virginia Public Service, as permanent treasurer and George R. Conover, Philadelphia Electric, permanent secretary. Previously Tom P. Walker of Beaumont, Tex., had been elected president.

The constitution and by-laws have been prepared and will be submitted to the membership. So far more than one hundred companies have become affiliated with the group.

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Donald C. Luce Promoted

Donald C. Luce was appointed this week general manager of electric operations of the Public Service Electric & Gas Co., Newark, N. J., to succeed the late Marion Penn. Mr. Luce was formerly general superintendent of electric generation.

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Plant to Spend $118,000

Wisconsin Public Service Commission has approved the application of the village of Waterloo for rehabilitation of its water and light plants and installation of additional equipment at a cost of approximately $118,000.

NEWS BRIEFS

MISSOURI ASSOCIATION OF PUBLIC UTILITIES' 1942 advertising campaign will include copy declaring that the state's non-municipal-owned public utilities have perfected plans to maintain service regardless of any type of "enemy action" and are ready for wartime emergencies.

THERE ARE 76 STARS, one for each man in the military services, on the service emblem in the Youngstown offices of Ohio Edison Co.

KENTUCKY UTILITIES Co. will give its 90,000 customers one month's free electric service, figured on meter readings during April, instead of a cash refund. Action follows orders of Public Service Commission for a rebate of $300,000, because of "excess profits."

KITCHEN PLANNING and modernization fundamentals, including step-by-step financing, will be shown in the Modern Kitchen Bureau's technicolor movie to local club women on April 21 in the Chicago Lighting Institute auditorium. Miss Elizabeth Haglund will also discuss care and preservation of home appliances.

EFFECTIVE DATE OF SPECIFICATIONS prohibiting use of rubber as insulation on neutral electrical wires has been changed from April 1 to May 1. Other "specs" issued at the same time (ELECTRICAL WORLD, April 4, 1942, page 73) remain in effect.

GENERAL ELECTRIC'S appliance and merchandise department has donated to the Treasury Department the use of a number of outdoor billboards for War Bond posters, according to Glenn Gundell, in charge of advertising at Bridgeport, Conn.

UNION ELECTRIC ELECTRICAL ENGINEERS estimate that war-time on the Union Electric system will cut the kilowatt peak by about 3 percent, but will reduce kilowatt-hours less than half of 1 percent.

CONSOLIDATED EDISON CO. of New York, Inc., paid a 1941 tax bill amounting to $1,842 for each employee, according to the company's fourth annual report, mailed this week to employees' homes. Last year labor got the largest share of each average dollar of revenue —26.2 cents for wages, salaries and pensions. The tax collectors got the second largest portion—24.2 cents.

PRESENT INSTALLED CAPACITY of Duquesne Light is 40,000 kw. in excess of peak demand to date, and a new 60,000-kw. generator is planned for the Phillips plant early next summer, according to Vice-President E. C. Stone.

Long-Range Power Plan Essential, Says Olds

FPC Chairman tells Midwest Power Conference that national power planning must be based on sufficient development of all regional resources to support coordinated war effort

FPC CHAIRMAN Leland Olds calls for long-range power planning

Because it takes from two to three times as long to create new power capacity as it does to create new industry, long-range power planning is essential to a successfully coordinated war effort, Leland Olds, chairman of the Federal Power Commission, declared in Chicago last week.

Speaking before more than 400 delegates to the Midwest Power Conference, Mr. Olds asserted that because of its vital relation to the war effort, a self-satisfied, *laissez-faire* attitude toward national power planning cannot be tolerated. Power planning, he stated, is based on development of regional resources to a sufficient extent to support a given war effort and the essential civilian participation. In terms of military strategy, therefore, the voice of commercial interest is no longer decisive, he declared.

All Areas Affected

Since the country's productive power may be located in areas not previously industrialized, war power planning must fully appraise the potentialities of *all* areas for development, in terms of power supply, to permit placing industries in rural and semi-rural communities.

Until early 1941, Olds stated, the commission's defense power supply estimates were used as a basis for regional conferences urging generating capacity additions. However, the July, 1941, long-range plan of specific additions to generating capacity grew directly out of the then-evident need for effective use of the country's capacity for turbine-generator manufacture and for an over-all allocation of essential materials, Olds asserted. A good deal of the pressure for the July, 1941, program, Olds stated in an aside, came from equipment manufacturers who said they would not be able to schedule production without such a plan.

V. G. Leach, Peabody Coal Co., in discussing fuel waste stated that 35,000,000 tons of fuel will be wasted in 1942 through improper maintenance of residential and industrial combustion systems. While industrial plant conditions are better than residential plants, 10 to 30 percent—depending on size and load—need attention, alteration or repair. Utilities, he stated, lead the procession in efficiency.

In discussing the forced-circulation boiler of the Montaup Electric Co., F. H. Rosencrants, Combustion Engineering Co., revealed that complete circulation of water in this 650,000-lb.-per-hour boiler takes place once every minute. This rapid circulation should maintain uniform distribution of any feedwater treatment, and therefore he felt any boiler water sample may be regarded as representative of that in all parts of the system. Since circulating pumps will always be started before fires are lighted, establishment of circulation is not dependent on application of heat, hence quick starting is possible. The Montaup boiler is a 650,000-lb.-per-hour unit delivering steam at 1,825 psi., 960 deg. total steam temperature.

Boiler Outage Causes

Most frequent causes of forced boiler outages traceable to tube failure, listed by E. G. Bailey, Babcock & Wilcox, in discussing ways to increase boiler output, were: (1) Improper feedwater treatment, (2) faulty boiler or water wall circulation, (3) priming and carryover to superheater and turbine, (4) leaks due to thermal stresses resulting from too rapid temperature changes, (5) corrosion or tube wastage, (6) cutting of tubes by soot blowers and (7) low water.

C. F. Wagner, Westinghouse, de-

MIDWEST POWER CONFERENCE—F. H. Rosencrants, Combustion Engineering Co., discussed operating experience with the forced-circulation boiler at Montaup Electric Co. in a session on central station practice, for which J. R. Michel was chairman; E. G. Bailey, Babcock & Wilcox, told how to get maximum output from existing boiler plants at this same meeting (all the above in left view, left to right). At the right, left to right, C. F. Wagner and A. C. Monteith, both Westinghouse, reported field experience with natural lightning and lightning-proof line design factors, respectively, at one of the two sessions on electric power transmission, presided over by E. W. Kimbark, Northwestern University

scribed modern techniques and instruments used in the field measurement of natural lightning and expounded the repetitive stroke theory of the propagation of lightning. At the same session A. C. Monteith of the same company reviewed practical considerations in the design of lightning-proof power transmission line.

C. A. Chayne, chief engineer Buick Motor Division of General Motors, in discussing power recovery from airplane engine test cells, reported that at the Melrose Park airplane engine plant, over an unspecified period of time, the energy generated by test cells amounted to 837,000 kw.-hr. while the energy purchased amounted to 796,800 kw.-hr. Of the total energy purchased and generated—1,633,800 kw.-hr.—123,800 kw.-hr. was returned to the public utility lines. Generated energy used was 85 percent of the total, while energy charge saved was 68 percent of the total. Based on experience at Melrose Park, he assured utility men that they could rest easy at the prospect of engine plants locating in their territory with "pump-back" equipment, so far as system disturbances were concerned.

H. W. Eales, Public Utility Engineering & Service Corp., speaking at an electrical engineers' luncheon, discussed control of oil fires through use of fixed CO_2 and water spray installations.

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Capacitors for Texas Power Pool

An installation of capacitors expected to be made within the next three months will permit existing facilities in a power pool of the Houston Lighting & Power Co., the Central Power & Light Co. and the Lower Colorado River Authority to deliver from 35,000 to 50,000 kw. additional power to war loads in this area, chief of which is the new magnesium plant at Freeport.

These capacitors, supplied by the General Electric Co. and obtained by the Defense Plant Corporation, will all be outdoor type, 15-kva. units in standard voltage ratings. Six hundred of the units will be rated 2,400 volts, 1,722 will be rated 7,200 volts and 666 will be rated 7,960 volts.

Most of the reactive correction is going on delta tertiaries of step-down auto-transformers, but some will be applied to distribution circuits. Two especially significant facts are these: (1) Capacitors can be manufactured and placed in operation very quickly; (2) a relatively small amount of auxiliary and protective equipment will be required. Shipment on the first units starts in five weeks from date of the order.

Canadians Foresee Power Rationing

Because there is not enough hydro-electric power for both, the Canadian government recently notified United States production authorities that this country must choose between more aluminum and a smaller supply of newsprint. Canada is now producing about 43 percent of all aluminum manufactured on the American continent.

In commenting upon this development, Lieut. Col. George A. Drew, Conservative leader in the Ontario Legislature, urged the Ontario Hydro-Electric Power Commission to make a complete blackout every night if it was necessary to alleviate the power shortage.

W. L. Houck, vice-chairman of the Hydro commission and member for Niagara Falls, replied that the commission was in the hands of the controller, H. J. Symington, and was prepared to cooperate with him to the limit. He assured the opposition leader that the commission was prepared to take care of the loads for any war plants.

Previously, Mr. Houck had reported that restrictions on the use of power would definitely come into effect early in the autumn—by October, at the latest. These restrictions would ban the use of illuminated signs, reduce street lighting and would include an educational campaign to show users how and when to conserve power. The sale of new hot water heaters has been stopped, but those already in use will not be interfered with. Users will also be asked to replace 60-watt bulbs with 25-watt.

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Eliminates Bonneville Line to Save Copper

Bonneville Power Administration officials have announced that more than 180,000 pounds of copper will be saved for construction of transmission lines necessary for war industries as a result of permission granted by the city of Tacoma to Bonneville to utilize part of its system in supplying power to Bremerton.

The saving will result from the elimination of 15.7 miles of 115,000-volt transmission line construction by the Bonneville Administration between Potlatch and Allyn, Wash., in bringing power from the Tacoma Cushman plant to Bremerton. Under the agreement Bonneville will build a line from Allyn to Bremerton. The line will be supplied with power from the Cushman plant of the Tacoma city system at Allyn, eliminating the necessity of construction of a Bonneville line from Allyn to Potlatch during the emergency.

WEST COAST FINGERPRINTING—Key industries which are being called on to help provide the nation with adequate and effective war production are rapidly joining in the program of personnel identification offered by the Federal Bureau of Investigation. Among the first of the Northwestern Electric Co. organization in Portland, Ore., was L. T. Merwin, president and general manager, left. Charles C. Tanory, assistant identification expert of the Multnomah County sheriff's office, "rolls" his prints, as C. W. Platt, secretary-treasurer, center, and Walter J. Dennis, assistant general manager, await their turn

Canadian Utility Alters Merchandising Policies

War-time program calls for continuance of dealer relations department — Utility advertising will stress appliance service and maintenance — Appliance concessions canceled — Lighting departments maintained

For the duration of the war the British Columbia Electric Railway Co. will continue to operate its dealer relations department, will use institutional service and maintenance type of advertising beneficial to the entire industry and will encourage dealers in its territory to develop their service departments. At the same time the company has canceled all concessions and inducements formerly used to promote sales of load-building electrical appliances.

This, in brief, was the picture of the war-time program of the company presented by W. C. Mainwaring, general manager of the merchandising divisions of the company, at a recent meeting of dealers in the company's store at Vancouver, B. C.

Allowances Canceled

Under the new set-up, the electric range wiring installation allowance of $25 is canceled. Trade-in scrap allowances, which ran to $20 for electric ranges, have been discontinued. All advertising allowance to dealers, working out at $5 on ranges, have been canceled. Transfer allowances of $15 made to consumers who had used an electric range for five years and were moving to a new home have also been canceled.

The dealer relations department of the B. C. Electric will be maintained and will do all possible to assist dealers in the operation of their business and in solution of individual problems. The department especially will promote development of service and maintenance work among dealers.

Sales Reports Continued

The present practice of dealers sending in monthly reports of sales has been found highly beneficial, in that it enables the utility to prepare a summary of sales for its entire territory. These summaries are then made available to the trade. Under the new plan this summary will be continued and dealers will be granted an allowance of one dollar for each report received by the utility.

As long as existing stock is available, the rental plan on storage automatic gas water heaters will be continued.

The B. C. Electric will curtail and possibly eliminate its merchandising and price advertising, but instead will carry on an advertising campaign to educate the public on the importance of proper maintenance and servicing of present appliances.

Installment sales are naturally out of the company's hands, but sales made will conform to the regulations of the War-Time Prices and Trades Board. The company will finance for dealers the wiring installation costs on electric ranges, since, in general, finance companies handling dealer paper will not carry installation charges. Such installation financing will be on the approved government installment terms of one-third down and will be routed through the Vancouver Electrical Association as at present.

The home service department of the company will be maintained as a service rather than as a promotional institution and cooking schools will be canceled for the duration.

Taking its cue from Great Britain, where even under war conditions improved lighting is recognized as desirable in the interest of maintaining public morale, the B. C. Electric will continue to operate its home lighting advisory service. Its commercial and industrial lighting operations will be continued as demands on these departments of the company are now mainly in connection with war industries.

The agricultural division of the company will be maintained as more and more farmers in the utility's area are turning to electric installations as a partial solution to the steadily increasing shortage of farm labor.

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Runaway Army Balloon Holds Up Kentucky Service

Service to most of western Kentucky was interrupted for 22 minutes by an Army barrage balloon which escaped from Camp Tyson, in Tennessee, and entered the Kentucky Utilities Co. system at Princeton, Ky., trailing some 2,000 feet of steel cable. Here it tore down four spans of 33-kv. line, went on to slice its way through two 4,000-volt rural lines and then tackled the 66-kv. double-circuit trunk line between Paducah and Earlington, where it severed all three conductors of one circuit and tangled them with the other circuit.

One hour later the balloon crossed the path of another 22-kv. line near Clay, 24 miles away, causing breaker operations but no damage to line. Five miles further on the cable became lodged in the forks of a large tree.

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Code Modifications Adopted for Duration

Recommendations for two wartime emergency amendments to the National Electrical Code have been adopted "for the duration" in accordance with letter ballots by the electrical committee of the National Fire Protection Association, according to Alvah Small, committee chairman (ELECTRICAL WORLD, March 21, 1942, page 98).

One adopted proposal approves the use in defense emergency buildings on circuits not over 208 volts to ground of "non-metallic sheathed cable, having one circuit conductor without individual insulation but assembled with an insulated conductor or conductors beneath an over-all fibrous covering." Uninsulated conductor is to be used only as grounded circuit conductor. This amendment, Section 3372 of Article 336, also specifies that junction boxes, outlet boxes, covers and switch and receptacle plates on branch circuits shall be of non-conductive material approved for the purpose.

The second accepted recommendation permits the use of slow-burning, weatherproof conductors (type SBW) and weatherproof conductors (type WP) as the grounded neutral in a.c. interior wiring systems not over 208 volts to ground; it will be printed as a note preceding paragraph "a" of Section 3005.

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President Indorses Bill to Set-Up New Power Group

Legislation to create a Columbia Power Administration in the Pacific Northwest, sponsored by Senator Bone of Washington (ELECTRICAL WORLD, April 4, 1942, page 5), has been indorsed by President Roosevelt in a letter to the Senator which states that the enactment would mean "more airplanes, more ships and more raw materials and implements of war."

The bill would provide for the acquisition by the CPA of private utility corporations and would direct that funds for their purchase and operation by that body should be raised by means of revenue bonds payable from the power revenues of the Bonneville and Grand Coulee projects.

Refuse to Postpone Puget Sound Suit

Condemnation suit of the Public Utility Districts of Thurston, Cowlitz and Lewis counties in the state of Washington against the Puget Sound Power & Light Co. of Seattle is under way in federal court in Tacoma, Wash., after refusal of Federal Judge James A. Fee to consider pleas by the utility company's attorneys to postpone the action. The power company declares it is deeply involved in the war effort and that this would be seriously affected by the litigation.

In deciding to proceed with the case, Judge Fee declared: "If the war effort at the present time makes it desirable that we postpone civil litigation, then it should be upon the executive branch of the government so to order."

In the opening statement of E. K. Murray, attorney for the PUDs, a valuation of $4,500,000 was set on the current, combined assets of the Puget Sound utility in the three districts involved. This sum is divided into $2,400,000 for Thurston County, $750,000 in Cowlitz and $1,300,000 in Lewis, such figures not including the goodwill, future business and other such items. Mr. Murray placed an estimate of $6,800,000 on the cost of reproducing the company's physical assets in the three counties as of April 1, 1941, estimating that depreciation would cut the figures down from one-third to two-fifths.

The PUDs brought suit singly against the company, but the suits were pooled for trial, with the jury being asked to make separate decisions for each county.

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Underwriters' Tells of Wartime Activities

Priority control of critical materials has resulted in a steadily increasing stream of proposals for substitutions in the products tested by Underwriters' Laboratories, according to Alvah Small, president.

The safety standards for a large number of products have been revised where necessary to permit the recognition of these substitute materials "for the duration only," but in all cases there is assurance that the safeguarding of equipment is maintained at a high level, he told the annual meeting last week.

A decline of 18 percent during 1941 in the work of investigating new electrical products was attributed by R. B. Shepard, chief electrical engineer, as reflecting "increase use of electrical manufacturing facilities for war products."

Asa H. Nuckolls, chemical engineer, reported on the testing of electrically conductive rubber for use as floors and as soles and heels of shoes. "Work continues," he said, "on specially designed explosion-proof motors, lighting fixtures and other electrical equipment for use in hazardous locations."

MEETINGS

Northwest Electric Light and Power Association—Engineering and operating section, Olympic Hotel, Seattle, Wash., April 23-24. Berkeley Snow, executive secretary, 418 Spalding Bldg., Portland, Ore.

Maryland Utilities Association — Spring meeting Lord Baltimore Hotel, Baltimore, Md., April 24. Wilson Cook, secretary, Potomac Edison Company Bldg., Frederick, Md.

Association of Iron and Steel Engineers—Spring conference Royal Connaught Hotel, Hamilton, Ontario, Canada, April 27-28. Brent Wiley, managing director, Empire Bldg., Pittsburgh, Pa.

Chamber of Commerce of the United States — Annual meeting, Washington, D. C., April 27-30.

American Institute of Electrical Engineers — North Eastern District, Schenectady, N. Y., April 29-May 1; summer meeting, Chicago, Ill., June 22-26. H. H. Henline, national secretary, 33 West 39th St., New York, N. Y.

National Electrical Manufacturers Association — Spring meeting, The Homestead, Hot Springs, Va., May 11-14. W. J. Donald, managing director, 155 E. 44th St., New York, N. Y.

National Fire Protection Association — Annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J., May 11-15. Robert S. Moulton, technical secretary, 60 Batterymarch St., Boston, Mass.

National Electrical Wholesalers Association—Annual convention, The Homestead, Hot Springs, Va., May 17-20. E. Donald Tolles, managing director, 165 Broadway, New York, N. Y.

Arkansas Utilities Association — Annual convention, Arlington Hotel, Hot Springs National Park, Ark., May 18-19. R. E. Ritchie, secretary, P. O. Box 551, Little Rock, Ark.

National Metal Trades Association—Annual convention, Biltmore Hotel, New York, N. Y., May 19-20. Harry S. Flynn, secretary, 122 S. Michigan Ave., Chicago, Ill.

Missouri Valley Electric Association—Accounting conference, Hotel Continental, Kansas City, Mo., May 21-22. I. D. Pettegrew, director, 1527 Sharp Bldg., Lincoln, Neb.

Pacific Coast Electrical Association—Annual convention, Fairmont Hotel, San Francisco, Calif., May 21-22. Victor W. Hartley, managing director, Edison Bldg., Los Angeles, Calif.

National Association of Purchasing Agents—Annual convention, Waldorf-Astoria Hotel, New York, N. Y., May 25-27. G. A. Renard, executive secretary-treasurer, 11 Park Place, New York, N. Y.

American Society of Mechanical Engineers—Semi-annual meeting, Statler Hotel, Cleveland, Ohio, June 8-10. C. E. Davies, national secretary, 29 West 39th St., New York, N. Y.

National District Heating Association — Annual meeting, Dayton Biltmore Hotel, Dayton, Ohio, June 11-12. John F. Collins, Jr., secretary-treasurer, 827 N. Euclid Ave., Pittsburgh, Pa.

American Society of Heating and Ventilating Engineers—Semi-annual meeting, St. Paul Hotel, St. Paul, Minn., June 15-17. A. V. Hutchinson, secretary, 51 Madison Ave., New York, N. Y.

Public Utilities Advertising Association — Annual convention, Hotel Commodore, New York, N. Y., June 21-24. E. N. Pope, secretary, Carolina Power & Light Co., Raleigh, N. C.

American Society for Testing Materials—Annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J., June 22-26. R. E. Hess, assistant secretary, 260 S. Broad St., Philadelphia, Pa.

Canadian Electrical Association—Annual convention, Manoir Richelieu, Murray Bay, Que., June 25-26 (tentative). B. C. Fairchild, secretary, 804 Tramways Bldg., Montreal, Que.

Utility System Has 410,000 Kw. on Order

Almost one-half of the $37,800,000 authorized for new construction in 1942 by the Commonwealth & Southern Corp. system will be spent for additional generating capacity, according to Justin R. Whiting, president.

A total of 410,000 kw. (nameplate rating) of steam generating capacity is on order for installation, he added, 125,000 kw. being scheduled for operation in 1942, 160,000 kw. in 1943 and 125,000 kw. in 1944. As to location, 100,000 kw. is for Michigan, 100,000 kw. for Alabama, 80,000 kw. for Georgia, 70,000 kw. for Ohio and 20,000 kw. each for Indiana, Mississippi and Florida properties. When completed, this will make the total capacity of the Commonwealth & Southern group of properties upward of 3,000,000 kw.

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Senate Subpoenas Patents on Electrical Equipment

Patents on electrical equipment and related products in the electronic field were among those subpœnaed from the files of the Justice Department by the Senate patents committee, as a preliminary to an investigation to determine whether patents, held here and abroad, may be impeding full-capacity production of vital materials and war materiel.

Other subpœnas, calling for the delivery of documents for committee scrutiny, have been issued, according to Senator Bone, committee chairman, to companies in many fields of war production, including General Electric Co. Under the terms of licensing legislation sponsored by Senators Bone, O'Mahoney and LaFollette, the President could grant a license to any person under any patent or patents relating to production for war and require the use of such instruments to the best interests of the nation and prescribe a "reasonable royalty" for such use. The President might also acquire patents for the government "by donation, purchase, taking or otherwise."

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Power Rationing Weighed

Some rationing of power to non-defense consumers may be necessary throughout the Niagara Hudson Power Corp. system, Floyd L. Carlisle, chairman of the utility, declared at the annual meeting of stockholders held this week. He added that war industries would receive first call on all power facilities throughout the system.

Output Gain Over '41 Widens Despite Dip

In the week ended April 11 the electric light and power industry distributed a total of 3,320,858,000 kw.-hr., according to the Edison Electric Institute, 14.3 percent more than in the corresponding week of last year.

Output in the most recent week was some 28 million kw.-hr. less than in the week ended April 4, but the decrease was less than in the similar week of a year ago. As a consequence, the margin over a year ago increased, the 14 percent gain being the largest since the week ended February 21.

Four of the major geographic regions reflected this increased margin. The gain was most marked in the New England, Central Industrial and Southern States regions, with the latter's 19 percent margin over a year ago the largest for this section since the week ended February 7.

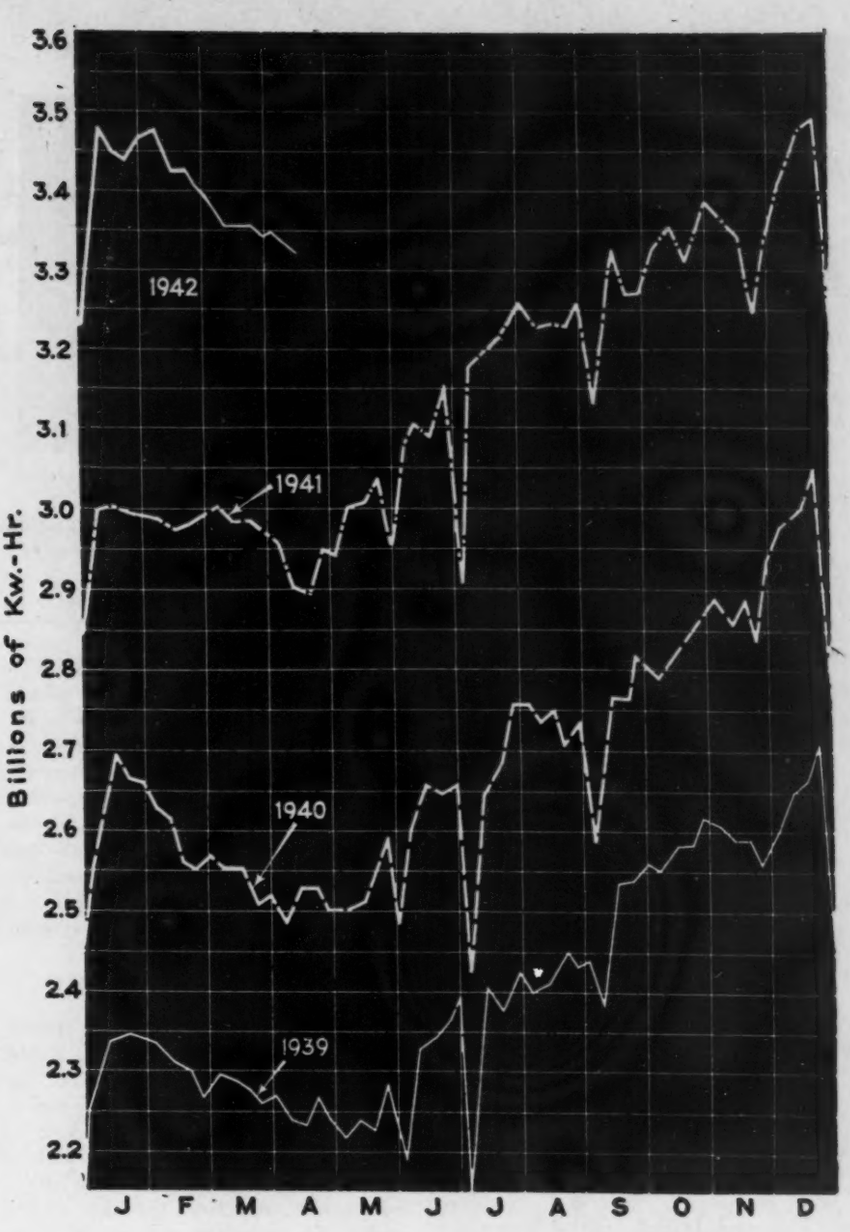
Weekly Output, Millions Kw-Hr.

1942		1941		1940	
Apr. 11	3,321	Apr. 12	2,906	Apr. 13	2,530
Apr. 4	3,349	Apr. 5	2,960	Apr. 6	2,494
Mar. 28	3,346	Mar. 29	2,975	Mar. 30	2,524
Mar. 21	3,357	Mar. 22	2,983	Mar. 23	2,508
Mar. 14	3,357	Mar. 15	2,984	Mar. 16	2,550
Mar. 7	3,392	Mar. 8	3,005	Mar. 9	2,553
Feb. 28	3,410	Mar. 1	2,993	Mar. 2	2,568
Feb. 21	3,424	Feb. 27	2,986	Feb. 24	2,547
Feb. 14	3,422†	Feb. 15	2,976	Feb. 17	2,565
Feb. 7	3,475	Feb. 8	2,989	Feb. 10	2,616

Percent Change from Previous Year

	Week Ending		
	Apr. 11	Apr. 4	Mar. 28
New England	+12.4	+ 9.3	+ 9.8
Mid-Atlantic	+ 9.7	+ 9.0	+ 8.4
Central Industrial	+12.3	+10.2	+10.1
West Central	+ 8.8	+11.5	+12.4
Southern States	+18.6	+14.8	+11.7
Rocky Mountain	+ 7.7	+13.3	+13.6
Pacific Coast	+26.4	+28.3	+28.8
Total United States	+14.3	+13.1	+12.4

† War-time began.



FPC Rate Study Discloses Downward Trend Since '24

The trend of average residential bills in cities of 50,000 population or more has been downward year by year since October 1, 1924, according to a report this week of the Federal Power Commission, showing electric rates as of January 1, 1942, for residential, commercial and industrial service in 199 U. S. cities.

According to the report, rate reductions in one or more typical bills for residential service were made by 26 of the 156 utilities in 37 cities in 1941, as compared with reductions made by 60 utilities in 65 cities during 1940. In three cases increases were made for certain blocks of consumption only and were accompanied by decreases in other blocks. In the two other instances the increases were occasioned by tax and fuel clauses.

Copies of the report are available at 10 cents each from the Federal Power Commission.

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Alabama Utility Starts Appliance Repair Plan

"Help win the war by repairing your electric appliances," is the theme of a campaign being conducted by the Birmingham Electric Co. and some 75 cooperating dealers.

"America faces a shortage of certain metals used to make electric appliances," says the appeal. "Besides this, appliance factories are changing over to the manufacture of weapons and equipment needed to win the war.

"Fewer electric appliances will be made until the war has ended. Every housewife can do her bit for victory by making her appliances last longer.

"Look in your closets now. If you have an electric iron, cooker, toaster, percolator or other small appliance that won't work—have it repaired. Put it back on the 'firing line' in your kitchen. And, just to be sure your larger appliances are in tip-top condition, have them checked too."

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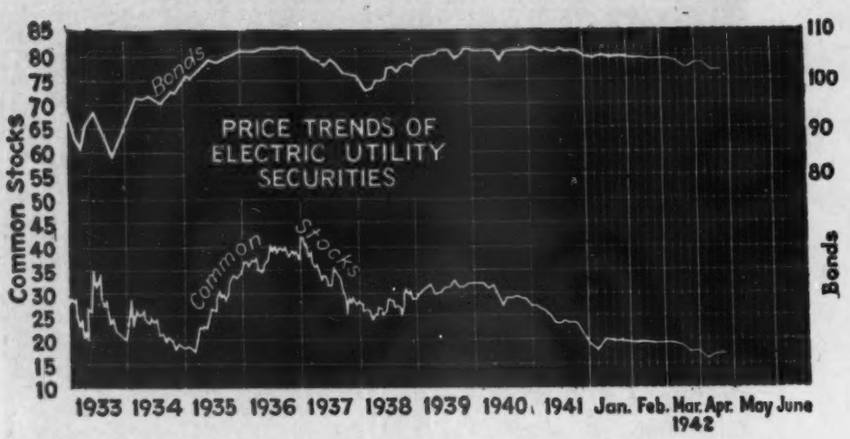
Quarterly Meter Reading

Wisconsin Public Service Commission has revised its rules to authorize the reading of meters in certain areas once every three months instead of once each month as at present. The new ruling has been announced to enable Wisconsin electric utilities to conserve automobile tires.

Utility Securities Move in Narrow Range


PRICE TRENDS OF ELECTRIC UTILITY SECURITIES
Bonds
Common Stocks
Common Stocks
Bonds
85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10
110 100 90 80
1933 1934 1935 1936 1937 1938 1939 1940 1941 Jan. Feb. Mar. Apr. May June 1942

Utility stock and bond prices moved within a narrow range the past week. "Electrical World" stock index remained at 17.3; last year, 24.7. The bond index dropped to 102.3 from 102.4 the previous week; last year, 106.0

American Light Will Liquidate

The American Light & Traction Co. is to be liquidated, according to William G. Woolfolk, president, who announced that a plan is to be completed and filed with the Securities and Exchange Commission as soon as possible.

Last August the SEC ordered the utility to dispose of its investments in San Antonio Public Service, Detroit Edison and other non-electric utility holdings. This order, plus the prospects of subsequent ones, prompted the management to liquidate the company "by distributing among the stockholders, on a basis found to be fair and equitable, such of its assets and investments as cannot be advantageously sold."

This week United Light & Power Co. was granted another year in which to comply with the SEC order of dissolution handed down on March 20, 1941.

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SEC Orders Continue "Death Sentence"

New evidence that the Securities and Exchange Commission plans to continue its enforcement of the "death sentence" clause of the Public Utility Holding Company Act appeared this week.

In one of its most severe orders the commission ordered North American Co. to divest itself of all interest in all its sub-holding companies and their respective subsidiaries except the single, integrated system of the Union Electric Co. of Missouri, and that only in an abridged form, within one year. This time limit is subject to extension at the discretion of the commission.

In its seventh annual report, released this week, the SEC cited the war as a reason for maintaining enforcement of Section 11(b), under which the agency has the power to order recapitalization, and said nothing to indicate that the same was not true of Section 11(b)1, which gives the commission authority to require geographical integration of holding company systems.

Corporate Structure "Repugnant"

Holding that the present corporate structure is "repugnant" to the Public Utility Holding Company Act, the SEC had previously directed Commonwealth & Southern Corp. to reduce its capitalization structure to one class of stock, and that to be common stock, within one year from the date of the order. No suggestion was made as to how this might be carried out, except that it is to be done "in an appropriate manner."

Utility Reports

	Net Income 1942	1941
*Arkansas Power & Light...	$2,074,287	$1,197,943
*Birmingham Electric	907,069	514,697
*Central Arizona Light & Power	665,840	841,706
*Dallas Power & Light.....	1,866,014	2,036,816
*Florida Power & Light....	2,495,129	2,332,292
*Houston Lighting & Power	2,912,181	2,939,385
*Idaho Power	1,256,526	1,504,550
*Louisiana Power & Light..	1,162,971	992,926
*Montana Power and subs.	3,480,548	3,962,925
*Nebraska Power	1,506,103	1,690,174
*New Orleans Public Service	2,635,161	2,652,124
*Pennsylvania Power & Light	6,553,664	8,556,381
*Texas Electric Service.....	1,195,727	1,254,515
*Utah Power & Light and subs.	1,927,886	2,039,330
*Washington Water Power and sub.	1,907,068	2,788,606

*Twelve months ended January 31.

PRIORITIES AND PRICE SHORTS

THE WAR PRODUCTION BOARD'S ballyhooed "stop order" on virtually all new construction doesn't directly affect utilities. They still operate under the terms of Order P-46, which for some time has banned any work costing in excess of $500 ($1,500 underground) without prior Washington approval. Even the building stop order permits certain types of construction—highways and industrial are examples—up to $5,000 without restriction. The order may, however, eliminate any need for canceling the existing utility permission to add up to 250 feet of line without advance okay.

AN AMENDMENT TO ORDER L-65, halting production of household electrical appliances on May 31, reduces the permissible output until the deadline on April 25 from 25 percent of 1941 sales to 20 percent. A further change, incorporated over protests from some within WPB, invokes the terms of the aluminum, nickel, copper, steel and tin conservation orders in use of materials going into the final production. Effect will be to prevent use of some inventory materials containing these metals. Only exception permitted allows use of resistance material (containing nickel or chrome or both) up to 15 percent of the 1941 value—on the ground that the scarce metals couldn't be recovered anyway.

USED ELECTRIC GENERATING EQUIPMENT and used steam boilers may not be sold, leased or optioned without specific authorization from the Director of Industry Operations, according to a WPB order, effective April 12. Equipment with an actual or market value of less than $1,000 per unit is exempt from the order.

REVISED PRICE SCHEDULE No. 102 establishes maximum prices for sales of mechanical refrigerators by manufacturers to persons with an A-10 or higher rating who are eligible to buy new units now. The schedule reflects unusual servicing and storage costs.

THREE OPA PRICE INTERPRETATIONS make clear that dealers may add excise and sales taxes to retail ceiling prices for electrical appliances. One interpretation covers vacuum cleaners and another the 44 household appliances under Temporary Regulation 18. The third applies only to Frigidaire dealers who bought directly from a factory branch this year and paid a federal excise tax, calculated differently than on the price freeze date.

HOW DESIGN . . . CONSTRUCT OPERATE MAINTAIN

Electrical Apparatus

8-Ton Transformers Sledded on Ice

A method for moving heavy transformers in freezing weather has been divulged by William Fitzstephens, assistant superintendent of distribution, Montana Power Co. Two 300-kva., 50,000/2,300-volt transformers had to be moved a distance of 1½ miles in cold weather last winter. The weight of each, including oil, was eight tons. Furthermore, the transformers could not be out of service more than six hours.

There was about 4 in. of snow on the ground at the time and the temperature was about 20 deg. below zero. The city fathers were induced to sprinkle the streets and alleys of the shortest route to the new location, making an iced roadway. A sled was constructed of 1x4-in. strap iron, curved up at the front ends, for the runners, on which the transformer wheels could be loaded. Pieces of similar dimensions were then welded crosswise of the runners, one in front of the front wheels and one just back of the rear wheels.

TRANSFORMER (300 kva.) goes for a sleigh ride

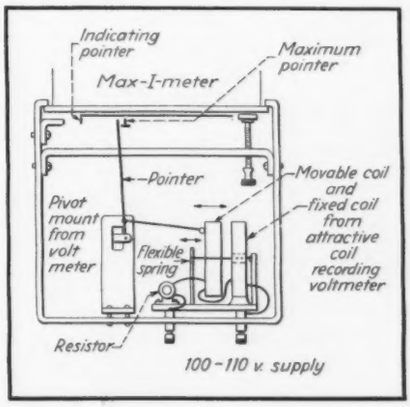
The transformers were readily loaded, one at a load, on the sled, which was drawn by a 3-ton truck. The total time for loading, hauling and reconnecting was just within the six-hour limit. By the ordinary method of loading and hauling it would have taken three days for each transformer. Why the city was sprinkling streets at 20 deg. below zero is still a mystery to some people in Butte who saw the sprinkler but not the sled.

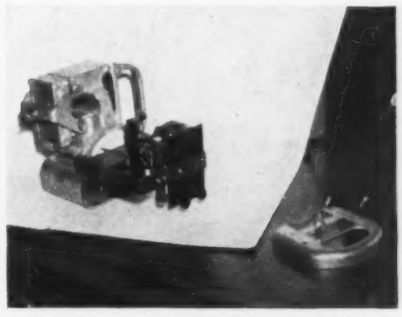
Meters

Device Guides Friction Adjustment

Oklahoma Gas & Electric Company uses a rebuilt attractive-coil recording voltmeter to guide periodic adjustment of maximum pointer friction in Max-I-Meters used by the distribution department for transformer load studies. It was found that if pointer friction was not checked periodically the pointer might become too loose and jar out of position or, if too tight, give under-registration.

The test device, shown, attaches to the face of the instrument being tested in the manner shown. First step in determining pointer friction is to measure the current drawn by the test device in moving its pointer to a given position. Then with the pointer of the test device in contact with the maximum pointer of the instrument, current drawn by the test device in moving the instrument's maximum pointer to the same position is measured. Difference in the two current readings is an indication of pointer friction. With the device used at Oklahoma City experience has shown this value should be between 20 and 25 milliamperes. Essen-





REBUILT attractive-coil voltmeter guides adjustment of pointer friction on maximum indicating ammeter

tial elements of the test device and features of its construction are shown in the accompanying sketch.

Line Engineering

Regulation Chart for Transformers*

By J. E. HOBSON† and R. L. WITZKE‡

An accompanying chart or monogram is useful for determining regulation of transformers at various secondary power factors, when the percent resistance and percent reactance of a particular transformer are known.

The chart is based on the formula

$$\%\ \text{Reg.} = (mq_r + nq_x) + \frac{(mq_x - nq_r)^2}{200}$$

where $m = \cos\theta$ = secondary power factor, $n = \sin\theta$ = reactive factor, q_r = percent resistance = effective short-circuit voltage drop due to resistance, as a percent of rated voltage, and q_x = percent reactance = effective short-circuit voltage drop due to reactance, as a percent of rated voltage.

An example of the chart's use follows. Assume transformer values of 1.0 percent resistance and 10.0 percent reactance. Draw a line between these points (see chart). Read the values where the line intercepts the power factor scales "A" and "B." The sum of the values will give the percent regulation; thus at 100 percent power factor 1.0 + 0.5 = 1.5 percent, at 80 percent power factor, 6.8 + 0.3 = 7.1 percent and at 50 percent power factor 9.2 + 0.1 = 9.3 percent regulation for the transformer.

* Excerpt from advance pages of "Electrical Transmission and Distribution Reference Book."

† Director of Electrical Engineering, Illinois Institute of Technology, Chicago.
‡ Central Station Engineering Department, Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

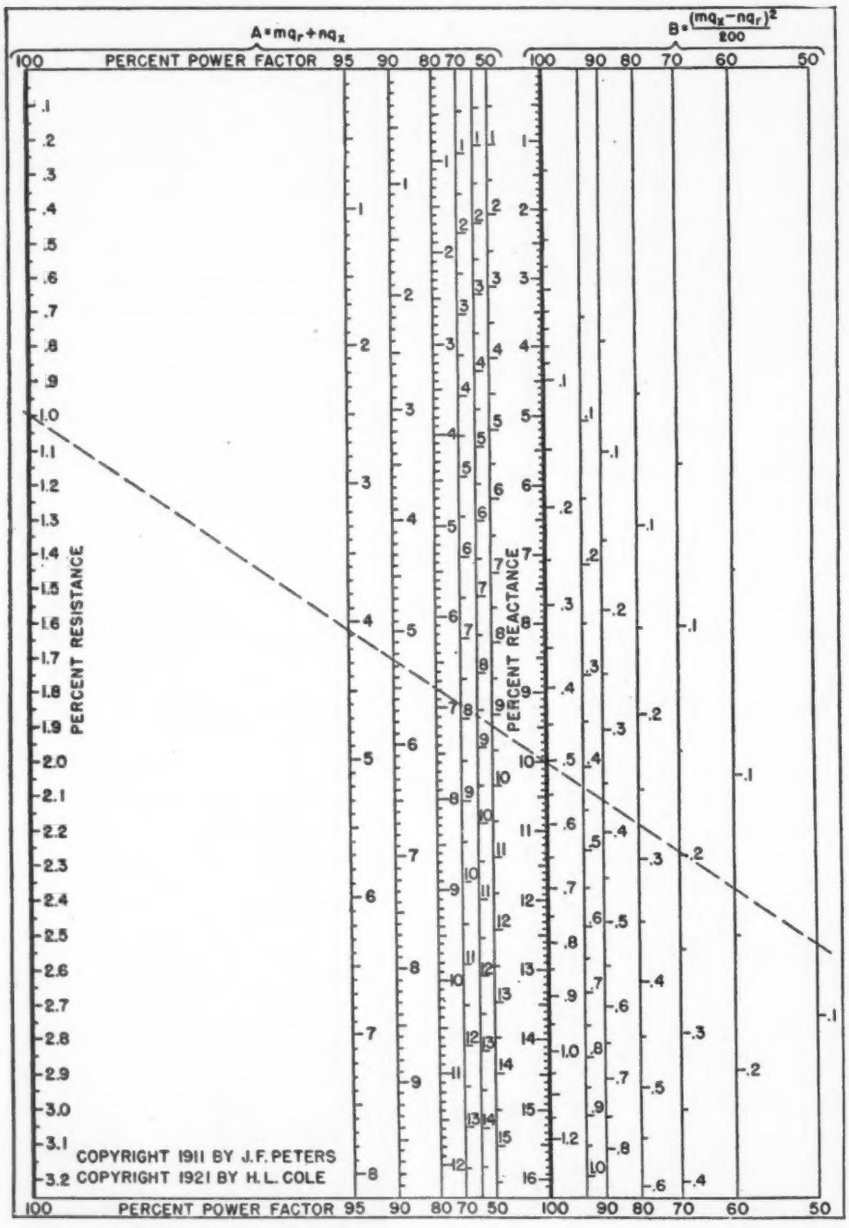

A = mq_r + nq_x
B = (mq_x − nq_r)² / 200
PERCENT POWER FACTOR 100 95 90 80 70 50
PERCENT POWER FACTOR 100 90 80 70 60 50
PERCENT RESISTANCE
PERCENT REACTANCE
COPYRIGHT 1911 BY J.F. PETERS
COPYRIGHT 1921 BY H.L. COLE
PERCENT POWER FACTOR 100 95 90 80 70 50
PERCENT POWER FACTOR 100 90 80 70 60 50

CHART for determining regulation of transformers

Directions: A straight edge placed across the resistance and reactance scales will give intercepts on the "A" and "B" scales, the sum of which will give the percent regulation for the respective power factors.

Electrical Machines

Novel Starter for Frequency Changer

By H. R. REESE

Superintendent Milwaukee Service Shop, General Electric Company

The Wisconsin Electric Power Company of Milwaukee has had in operation for some 25 or 30 years a 2,000-kva, two-unit, 300-r.p.m. vertical frequency changer with direct-connected 60-kw. exciter which provided interchange of power either way between its 13,200-volt, 25-cycle and 4,000-volt, 60-cycle systems. The set was originally designed for starting on the 25-cycle machine.

The frequency changer was used to supplement 25-cycle steam-generating capacity, so there was always 25-cycle power available for starting. But the 25-cycle load gradually decreased, and when the last major 25-cycle prime mover was scheduled to be taken out to make room for other new equipment the utility company was faced with the problem of making some provision for starting the frequency changer from the 60-cycle end.

Naturally, because the frequency changer would be retired within a few years, the company wished to spend as little money as possible to do the job. The logical solution of installing amortisseur windings on the 60-cycle field would have cost about $8,000, plus installation charges, and would have required a relatively long shut-down.

As an alternative, the idea of using the 60-kw. direct-connected exciter as

Expand with UNIT SUBSTATIONS

Slide the factory-assembled sections into position, make the necessary connections, and your unit substation is ready for service.

Your best bet for supplying fast-growing loads

SAVE
Time, Space, Material

PROPERLY co-ordinated, factory-built unit substations—one solution of your vital problem of supplying today's rapidly growing loads. They're easily and quickly installed—in days rather than weeks—with a considerable saving in important materials. ***They're easily moved when load centers change;*** you'll never have large blocks of capital tied up in idle substation equipment that you provided for future growth. Engineering and planning time are sharply reduced; you purchase the substation as a "package," from a single manufacturer, with a simple functional specification.

Their neat, attractive appearance makes G-E unit substations readily acceptable even in residential areas.

Compactly designed for outdoor service, unit substations make large investments in real estate and buildings unnecessary. And you can locate them ***close to load centers*** so secondary feeders are shorter (saving tons of vital copper), losses are lower, service better.

Add up these advantages. We think you'll agree: for the changing power requirements of today ***and*** tomorrow, unit substations offer the practical, far-sighted answer. Ask your local G-E representative for more information—or write direct for descriptive literature. ***General Electric, Schenectady, N. Y.***

General Electric and its employees are proud of the Navy award of Excellence made to its Erie Works for the manufacture of naval ordnance.

GENERAL ELECTRIC

a starting motor was suggested. The records showed that the motor's no-load running losses plus the excitation for one end of synchronizing amounted to approximately 80 kw., which the exciter could handle momentarily. Still questionable, however, was whether the exciter when operating as a motor could develop sufficient break-away torque and accelerate the machine. It was felt that if the voltage on the exciter could be boosted to 150, the plan was worth a try.

To provide power, a second-hand 150-kw., 125-volt, d.c. motor-generator set with a 2,300-volt driving motor and its starting equipment was installed, along with a new 150-kva., three-phase, 4,000/2,300-volt auto-transformer.

Upon attempting to start the frequency changer the static friction proved to be too high, although after the machine was broken away from standstill the exciter, operating as a motor, could bring it up to speed.

After investigating further, it was determined that the lower thrust bearing, which is of the six-section step-type and ordinarily lubricated by a gravity system, could be modified to provide pressure lubrication to lift the rotor before starting. Accordingly the bearing was drilled and tapped for piping and a 1-hp. motor-driven oil pump was obtained.

When the change in the lubricating system had been made the frequency changer was started without difficulty. Total cost of the equipment amounted to only $1,908. The set has been operating satisfactorily with this method of starting, and in recent months it has been carrying the Milwaukee end of the 25-cycle load of the Electric Interurban line between Milwaukee and Chicago.

Industrial Heat

Controlled Atmosphere in Electric Furnace

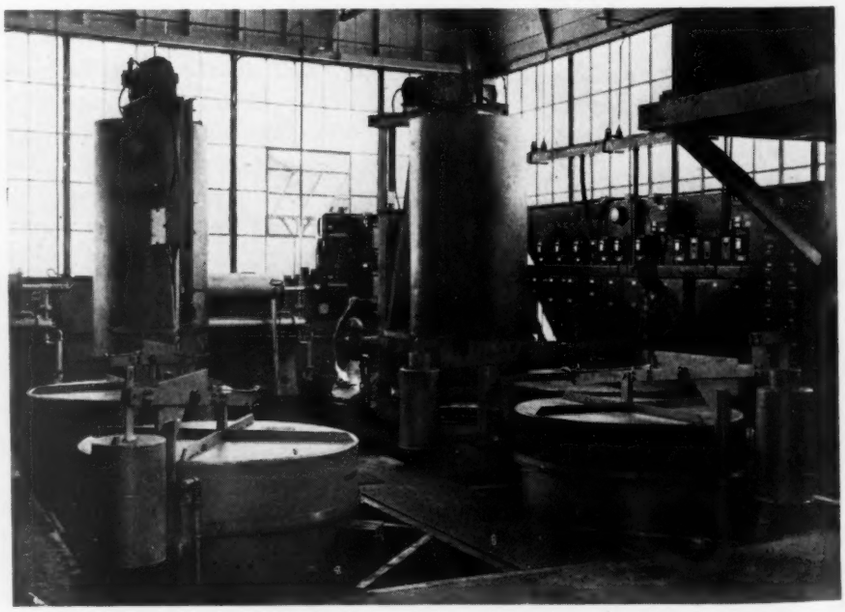
Heat treating of many airplane parts is essential in order that they may possess the elasticity and toughness necessary to withstand the strain of rapid climb, speed and high altitude maneuvers to which military aircraft are subjected. In producing parts for the speedy, high-flying "Lightnings," which is what British pilots have dubbed the single-seat Lockheed interceptors, a Western manufacturer has developed a hardening and drawing technique that utilizes controlled furnace atmosphere and a water-cooled oil quench.

To accomplish a job that would meet the specifications of today's high-geared production, there were installed four General Electric cylindrical electric furnaces, with atmosphere control for hardening and drawing, and an oil quench that is water-cooled. The two hardening furnaces have an inside clearance diameter of 30 in. and an inside depth of 85 in. The rating of each furnace is 95 kw., divided into three circuits in the height. The draw furnaces have an inside diameter of 30 in. with an inside depth of 76 in. and are rated 75 kw., three phase, "Y" connected. The oil quench tank has a depth of 7 ft. and a diameter of 4 ft.

So that the parts which are heat-treated will come from the furnaces clean and scale-free, two atmosphere gas converters are used. They keep the interior of the furnaces filled with an inert gas to protect the charge against undesirable chemical reaction with the furnace atmosphere and formation of scale. The gas analysis is constant regardless of changes in the rate of flow. Since the gas combustion controller can be set or reset without shutting down the machine, it has helped to conserve time. Having portable mountings, the machine has gained favor because of the small floor space it occupies.

Past experience has shown that one of the greatest difficulties in hardening and drawing tubular parts was encountered when the parts were transferred from the furnace to the quench tank. The two quenching hoods that are now used on these hardening furnaces protect the parts from excessive cooling while being transferred from the hardening furnace to the oil quench. The method employed in this transfer is simple. The cover of the furnace swings off and the hood is lowered over it. The charge is then hoisted from the furnace up into the hood by the special crane, which then swings the hood over to the quench tank and the charge is lowered into it. Furnace temperatures are controlled accurately and automatically.

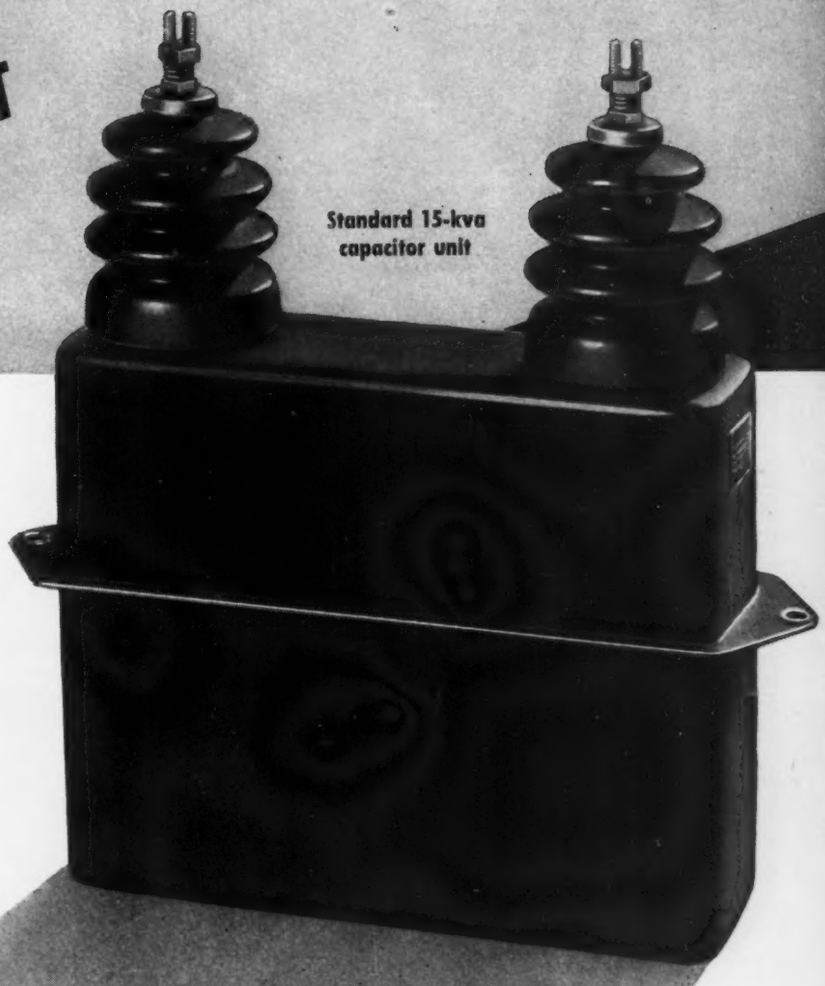
Since this installation, the manufacturer has placed an order for an additional heat-treating unit of larger dimensions. This unit consists of a hardening furnace, a drawing furnace, a quench tank and another atmosphere gas controller.



SUPERIOR, scale-free airplane parts are turned out by this General Electric furnace installation. Shown are two hardening furnaces and two draw furnaces in the foreground, which are equipped with atmosphere gas converters for protecting the furnace charge against undesirable chemical reactions with the furnace atmosphere. In rear are quenching hoods which cover furnace load during transfer to the quench tanks

How to put MORE LOAD ON A FULLY LOADED SYSTEM

WITHOUT A CHANGE IN SYSTEM LAYOUT



Standard 15-kva capacitor unit

CAPACITORS—your best bet for meeting the power requirements of over-night load growth. By relieving the system of reactive kva and improving power factor, they enable the lines to carry more working current—from 1/3 to 2/3 kva for each kva of capacitors installed. In many cases enough capacity is released to forestall the installation of new feeders.

Other Advantages of Capacitors

INSTALLATION TAKES LITTLE TIME. You merely build up banks of capacitors, and then make the necessary connections. When load centers shift, the capacitors can be moved to new locations. This avoids tying up capital in idle equipment.

COST IS LOW. On many feeders, it is only $7 per kva of capacitors installed.

Ask your G-E representative for a quick estimate of the increase in capacity and of the savings possible with Pyranol* capacitors, or write for descriptive bulletin, GEA-3333. *General Electric, Schenectady, N. Y.*

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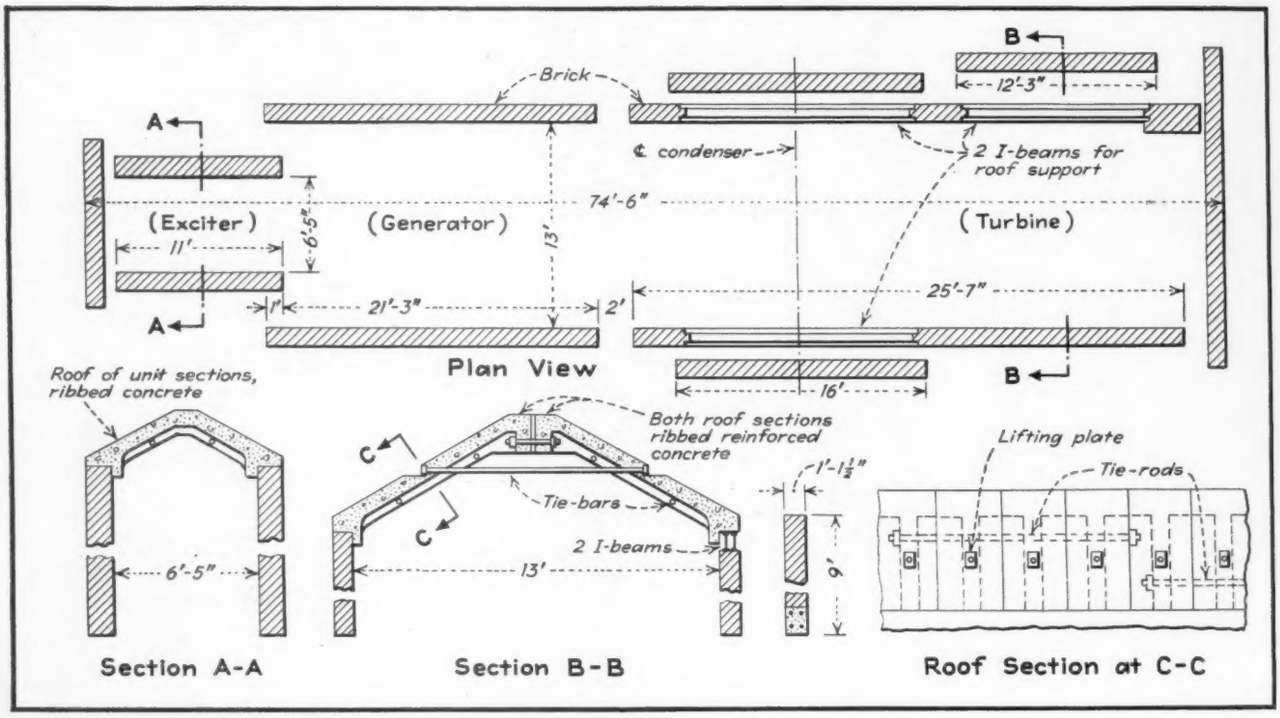
407-34-5700

HOW TO PROTECT Turbo-Generator Unit from Bomb Fractures

Steam Plant



DETAILS of structure built around a London (England) steam turbine-generator unit

"Air raid shelter" for turbo-generator unit in a London plant is built inside plant structure and close to machine, allowing passage space at sides for attendant to make inspections. Forced ventilation inside the shelter is provided by portable fans because there is no closed ventilating system on the unit.

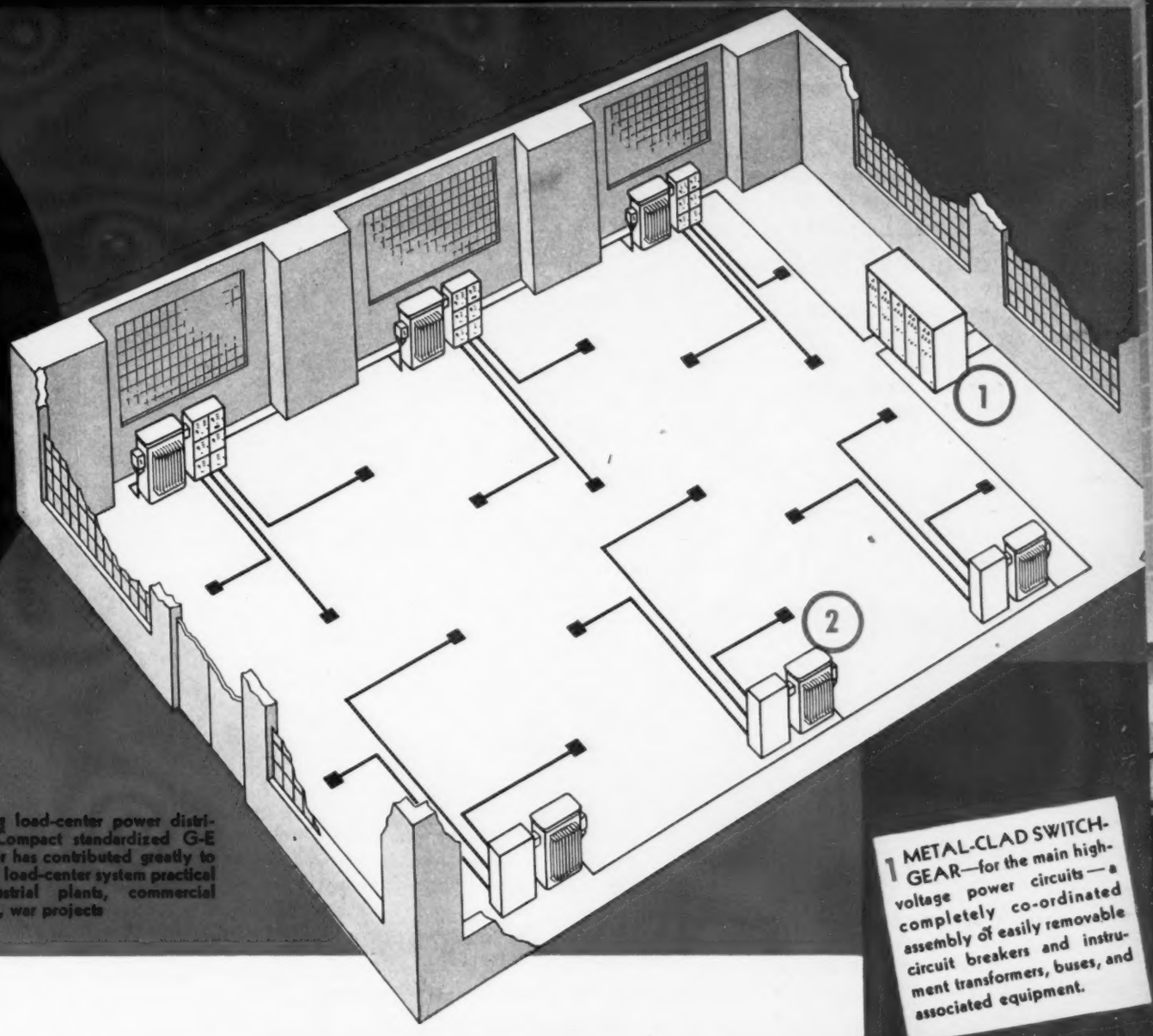
Side and end walls are brick, 1 ft. 1½ in. thick, constructed in sections and spaced according to width of machine and necessary lateral clearance. Section ends overlap about 1 ft. to prevent entrance of bomb fragments and flying debris, also to provide for air movement and entrances and exits for attendants. Wall height varies, depending on height of machine and an allowance for vertical clearance to the roof.

Roof for turbine and generator is constructed of 44 reinforced-concrete half-sections, which are seated on brick walls or I-beams or both, and has a 30-deg. pitch. Most of the sections are constructed for use on either side of the roof, are 2 ft. 8½ in. wide, 5 in. thick, have a rib 8 in. wide and 10 in. deep on the under side and are designed for an inside span of 13 ft. At the exciter end of the shelter, where the walls are close together (6 ft. 5 in. inside span), each of four sections of the roof is molded as a single unit and no cross tie-bar is needed. These unit sections are 2 ft. 5¾ in wide, 4 in. thick and have an 8x8-in. rib and there are two longitudinal tie-rods through them.

Over the turbine and alternator the two halves of the roof sections are bolted at the top; also, at about the mid-point on the pitch, are joined by 1⅛-in. diameter tie-bars extending through 1½-in. bore tubes placed in the concrete. A lifting plate is slipped on both ends of the tie-bars and is held in place when the bar nuts are tightened. At the exciter end two ¾-in. diameter rods, each bent to form a lifting eye, are imbedded in the concrete.

Half roof sections are assembled on the floor, then a lifting bar with spacer is attached to the lifting plates, and the assembled sections are hoisted and set in place on the walls and I-beams. In the same manner the unit sections are set at the exciter end. On each side of the roof adjacent sections in groups of four are joined together by 1-in. diameter tie-rods.

The above data on how to protect turbo-generator units from bomb fractures were sent to Davis M. DeBard, vice-president Stone & Webster Service Corporation, New York, N. Y., by Harry Towers, general manager Edmundsons Electricity Corporation, Ltd., London, England.



Illustrating load-center power distribution. Compact standardized G-E switchgear has contributed greatly to make the load-center system practical for industrial plants, commercial buildings, war projects

1 METAL-CLAD SWITCHGEAR—for the main high-voltage power circuits—a completely co-ordinated assembly of easily removable circuit breakers and instrument transformers, buses, and associated equipment.

2 LOAD-CENTER UNIT SUBSTATIONS—for distribution, control, and protection of low-voltage power up to 600 volts—a completely co-ordinated assembly of drawout-air-breaker switchgear equipments, transformers, and high-voltage protective devices.

EVERYTHING IN STATION SWITCHGEAR, TOO—Complete switchgear for the power station is described in our new bulletin, GEA-3742 — everything from large FH cubicles right down to the metal-enclosed bus runs.

Standard EQUIPMENTS

Get Any or All of Your Plant Switchgear Equipments This Easy Better Way

NOW you can save precious days and weeks formerly spent over the drawing board and in drawn-out correspondence. Now you need only give us a simple one-line diagram showing the switchgear functions to be performed and the ratings.

You'll get our standard switchgear—the best, and the safest, we know how to build.

You can get everything you need in plant switchgear this quick, simple way. Every one of our standard equipments is designed for the broadest possible application. Our line of standard equipments is complete. Ask your nearest G-E office for additional information, or write the General Electric Company, Schenectady, N. Y.

GENERAL ELECTRIC

854-16-7300

Truck Equipment

Low-Cost Ladder Attachment for Truck

A light pick-up truck has been converted into a ladder truck by the addition of a ladder attachment which was made of scrap metal (mostly old pipe). Material cost was 75 cents and labor was sixteen man-hours. The attachment is a rigid, metal framework hinged to the rear bumper, or, as in this case, to the trailer hitch, and accommodates a standard 36-ft. extension ladder which is hinged to the top of the framework by eye-bolts.

When not in use the ladder lies horizontally across the cab, extending about 5 ft. beyond the end of the truck bed. When it is to be used the base of the ladder is pulled down into the bottom of the framework and is held in place by a pin. Thus the ladder and framework become one rigid structure, hinged to the rear bumper or trailer hitch.

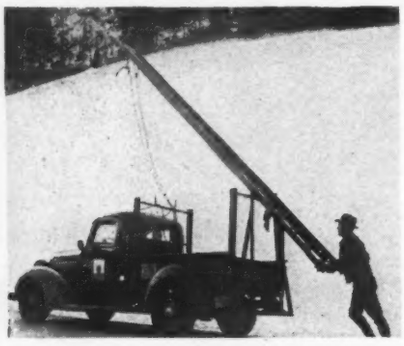
Two guy ropes are fastened to the top of the bottom section of the extension ladder before the ladder is elevated. The ropes are then tied to the front bumper. By varying the length of the guy ropes the ladder is held at various angles.

One man can attach the framework to the truck in approximately ten minutes, and the ladder can be attached to the framework in another five minutes. It takes about three minutes for two men to raise the ladder and attach the guy ropes. After the ropes are tied to the front bumper one man can quickly raise or lower the ladder to the desired height.

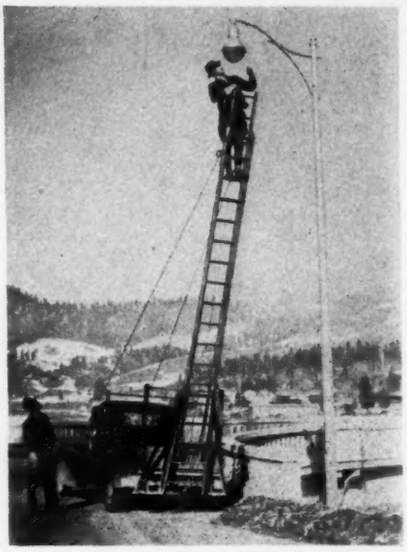
The economical ladder attachment is the development of an idea of Harold T. Stoddard, line foreman and engineer, and was built with the assistance of Sid King, lineman and service man, both employees of Washington Water Power Company at Orofino, Idaho.

Mr. Stoddard states that the attachment has proved invaluable for changing bulbs in curb standard street lights and for tree trimming. It possesses all the adaptability of a regular ladder truck, except that it can not be swung laterally.

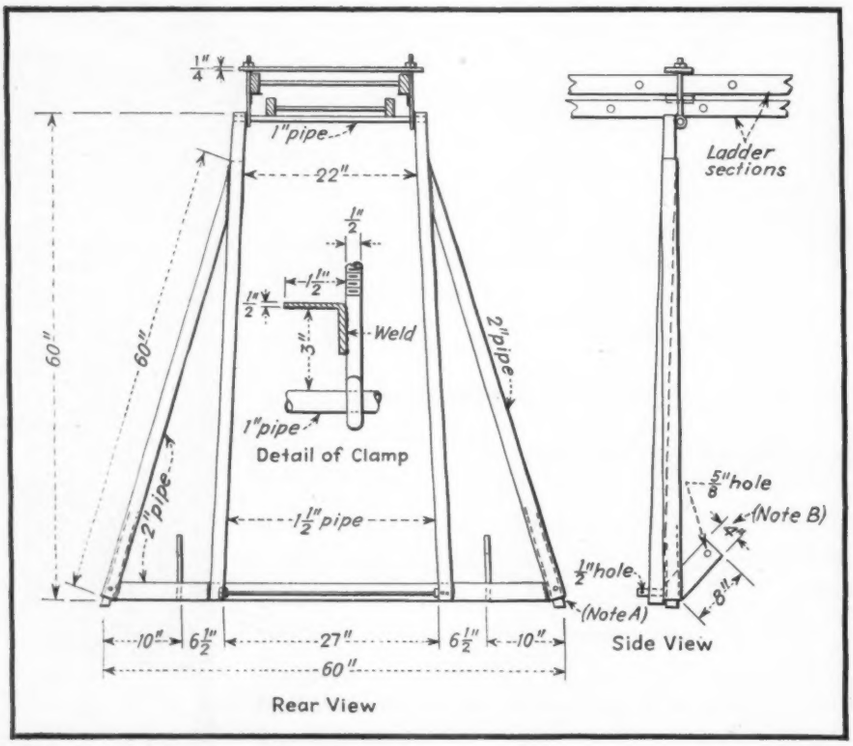
Given new material, Mr. Stoddard advises, they could build another attachment in less than half a day. In a well-equipped shop four man-hours and $4 or $5 for new materials will provide the attachment to convert a light pick-up into a ladder truck.



EXTENSION LADDER being raised, is hinged to ladder attachment at end of trucks; guy ropes are attached



CONVERTED pick-up truck in use



WORKING SKETCH for ladder attachment

Notes: (General) It might be necessary to vary dimensions to fit truck and ladder. All joints are arc welded. (A) 1½-in. pipe telescopes into 2-in. pipe, dropping down for "stiff leg" when desired. (B) Framework is attached to truck by two ⅝ x 1½-in. bolts.

Meters

Watt-Hour Meter Jewel Maintenance

Practice of the Dallas Power & Light Company is to remove and replace all watt-hour meter jewels and pivots in the field on the regular meter inspection schedule following the "as found" test, replace removed jewels with new ones or some that have passed meter shop inspection and return used jewels and pivots to the meter shop, for examination and cleaning.

Examination and cleaning procedure follows several steps: Jewels are sorted according to types. Those of a type are placed in hardwood blocks drilled to suit. They are next cleaned with salvasol and a toothbrush and allowed to soak in the solvent for a time. They are next cleaned with an

Announcing "THE SURVEYOR"

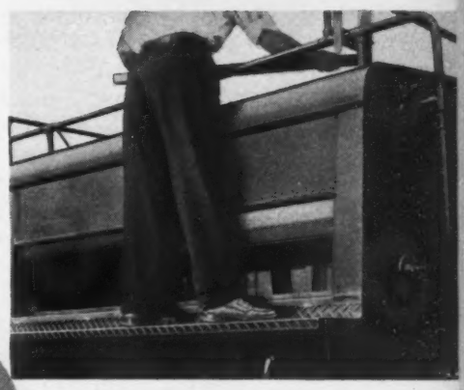
Model S-22

When the job must get going—*QUICK*

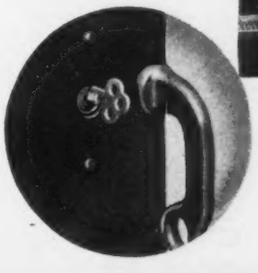
The faster and better the surveying crew can work, the quicker the job starts to roll. "The Surveyor" provides every advantage for efficient performance right from the beginning. It carries the crew into the field in comfort and safety; and saves many hours valuable time by furnishing correctly arranged spaces where transit, axes and other equipment can be securely stored and made easily accessible.

Six men ride in the compartment and two in the cab. Roomy seats with sturdy tubular frames are generously upholstered with imitation leather. Bus-type windows fitted with shatter-proof glass can be raised to seven positions. Upper sections are fitted with green shatter-proof glass to bar direct rays of sun. Compartment can be converted to carry more material by removing as many seats as necessary. Simply pull out one pin and lift out seat.

American all-steel construction—lighter and stronger—lowers operating costs by increasing carrying capacity with less dead weight. It saves gasoline and tires, gives longer service, and requires less servicing.



CATWALK of skidproof plate extends length of body. A great convenience in loading material on roof.



Flush-type built-in lock: Great improvement over conventional lock. Looks better, does not rattle, cannot be mislaid or lost. Locks all compartments on one side.

Other Noteworthy Features

• Rear door has locking type handle • Skidproof runway in center aisle • Finished to any specification • Mounted on conventional type chassis • Material compartments can be arranged to meet any need • Tire carrier on roof

Send for Bulletin B-12

THE *American* COACH & BODY CO.

WOODLAND AVE. AT E. 93rd, CLEVELAND, OHIO

PUBLIC UTILITIES EQUIPMENT FOR MOTOR VEHICLES

DRILLED BLOCKS for different jewel sizes, orange stick, probe, solvent, 30-power microscope with 100-watt spotlight and prism mark Dallas Power & Light jewel maintenance set-up

orange stick, blasted with an air jet to remove the solvent, and placed under a microscope for examination. A 30-power microscope is used with a 100-watt spotlight and prism to direct light into the jewel cup, as shown in the accompanying illustration. Any jewel showing the slightest surface break or wear at any point of the jewel cup is discarded.

The needle method of inspection is not used because it is nearly impossible to avoid rupturing the jewel surface. Also, it takes a sharp needle and light hand to detect defects.

After cleaning and examination reclaimed jewels are oiled, reassembled in the jewel screw and wrapped in tissue paper to keep them clean. Ball bearing jewels are not oiled.

Of the older type jewel and pivot bearings with brass mountings and sharp steel pivot about 54 percent of those turned in are discarded. In the later I-14 type using cobalt-tungsten rounded pivot bearing, in an oil-tight jewel screw, only about 23 percent are discarded. With the ball and cup type bearing about 12 percent, whereas about 21 percent of the upper jewels for the ball type are discarded. Average number of jewels tested during a twelve-month period is about 12,000, of which about two-thirds are I-14 jewels.

New Development

Recorder Measures Lightning Current

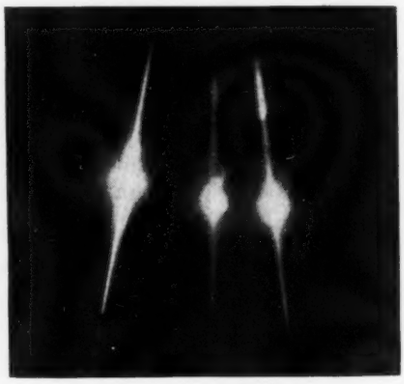
By G. D. McCANN
Central Station Engineering Department, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

For studies of currents in lightning strokes a new device has been developed, known as the "photographic surge-current recorder." This instrument is capable of measuring current as a function of time, records the multiple character of strokes, and has a wide enough range of current sensitivity to record the crest magnitude of stroke components and the wave shape of the low-magnitude, long-duration portion.

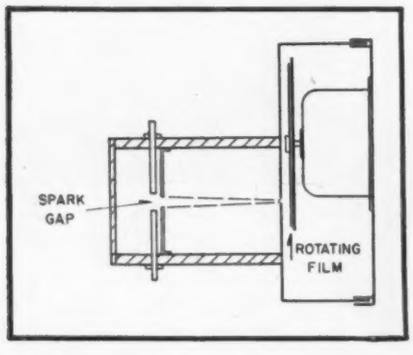
Principle employed by the recorder is that of photographing on a rotating film the intensity of a small spark gap carrying the surge current to be measured. Instead of a conventional lens system, a specially designed pinhole is so constructed that light from the spark gap spreads out in a non-uniform manner over the film perpendicular to its direction of motion. Greatest intensity is at the center axis of the pinhole and the intensity decreases with the distance from this axis. Thus, the width and density of the film image is a function of the luminosity of the arc and, therefore, of the arc current.

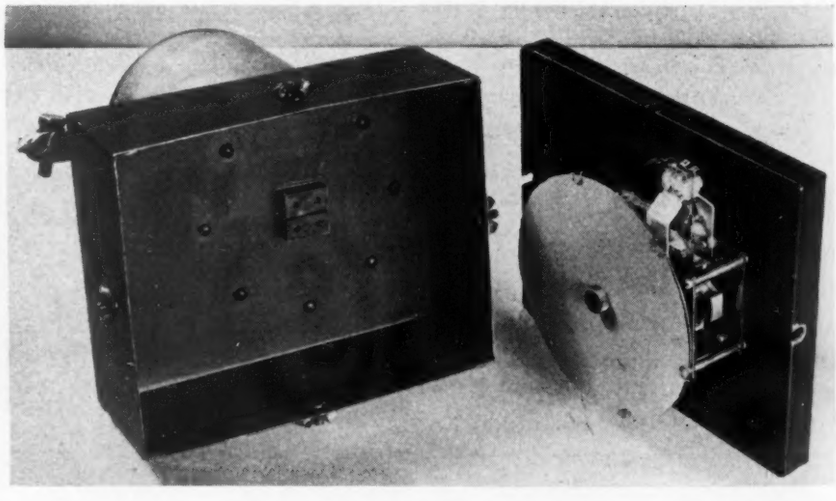
For a given current magnitude the film density can be measured with a densitometer at a distance from the center axis where the saturation point of the film density has not been reached. Currents can be measured to an accuracy of approximately 100 percent over the very great range of 0.2 to 150,000 amp.

The set of barriers prevents spreading of the image in the direction of motion of the film. Image width is 0.01 in., and for a recorder (shown) with a 5-in. diameter film rotating at one revoluation per second the time sensitivity is 600 microseconds. The rotating film is driven by a motor operating from 6-volt dry cell batteries. Its speed is maintained constant by a vibrator governor and it draws an average current of only 7 milliamperes, so that a set of four standard dry cell batteries will last several months.

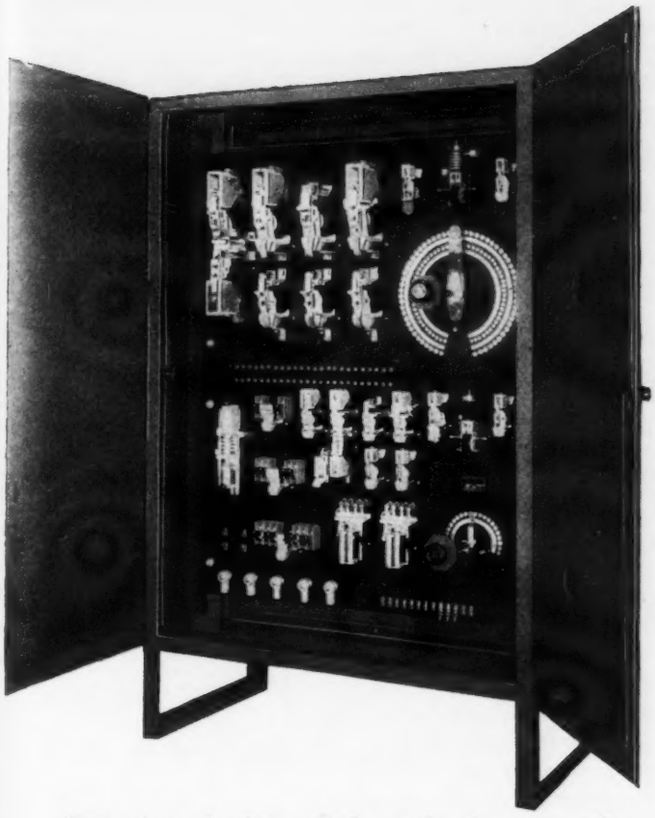


PHOTOGRAPHIC RECORD of a three-component stroke; current measured by width and density of film image





PHOTOGRAPHIC surge-current recorder: interior view (right) and schematic diagram (above)



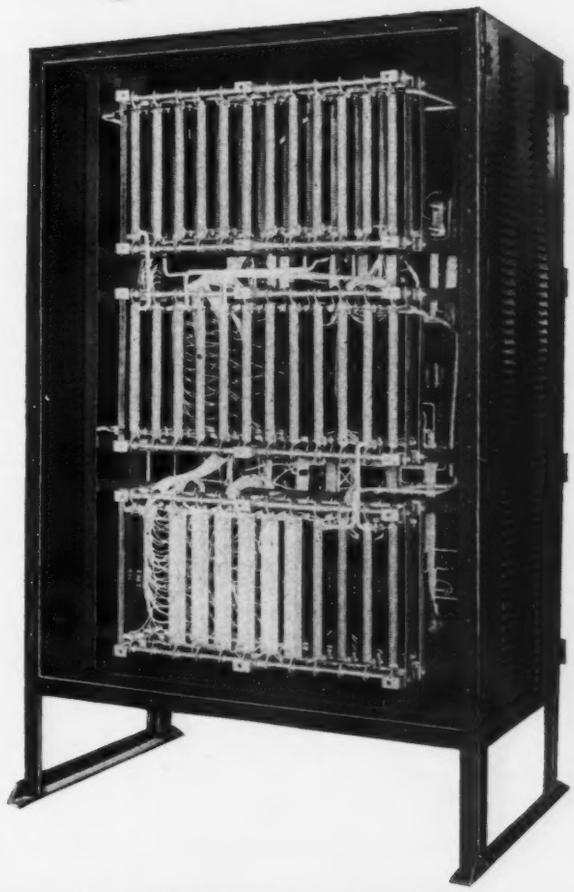
Front view showing control panel. A custom-made assembly of standard parts.

WE'RE proud of the job, ourselves. This Monitor Controller provides automatic hair-line control and speed regulation for a 60 H.P. textile calendering press making essential cloth materials for the war effort.

This kind of workmanship is "standard practice" at Monitor, and a phone call will bring one of our Field Engineers to show you how it can be applied to your particular control problem.

Monitor
BALTIMORE, MD.
The Original
"JUST PRESS A BUTTON" System

Monitor builds automatic electric motor control in all its phases. From fractional horsepower up to 1200 Ampere size . . . Pushbuttons, resistors, rheostats, starters, regulators. The Monitor line is complete.



Rear view showing resistor bank installed.

The Monitor Controller Company

GAY, LOMBARD & FREDERICK STS. BALTIMORE, MARYLAND

New Development

River Stages Sent, Recorded by Radio

By LYMAN RINKER
Electrical Engineer
Leupold & Stevens Instruments,
Portland, Ore.

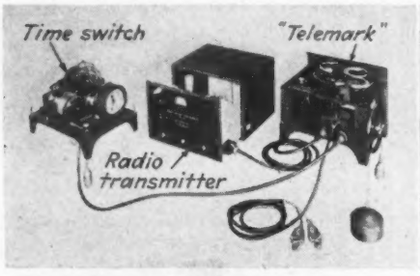
Developed particularly for those installations where telephone service is not convenient, this radio recorder transmits and records the position of a moving element—for example, water levels—using a coding device ("Telemark") to transmit gage heights at certain predetermined intervals in the form of signals which are automatically recorded by a pen on a time-stamped tape.

Similar equipment has been available for performing this task over ordinary telephone lines; such equipment is operated when the number assigned to a particular station is dialed (ELECTRICAL WORLD, June 17, 1939, page 1854). In the present development the radio equipment includes a transmitter and receiver, together with a weight-driven clock that operates as a time switch on transmitter operation.

The radio transmitter is designed for 10 watts input into the final amplifier. Operating frequency is in the three-megacycle band and is crystal-controlled. Primary power source is a 12-volt storage battery. The antenna is half-wave, single-wire fed.

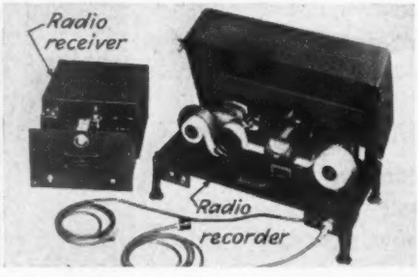
Receiver selectivity is such that the recorder will register only the desired signals. While the receiver is designed so that an input signal of less than one microvolt will register on the tape, this sensitivity cannot be fully obtained in practice because of noise actuating the a.v.c. circuit. Practical results, however, show that signals are recorded under conditions when the ear is unable to distinguish between signals and noises.

Normally, the device provides for twelve-hour transmission periods below flood stage and hourly above; these periods, however, can be adjusted to meet the requirements of each installation. An accessory feature of the instrument is a buzzer which sounds on the first impulse received. A push-button control silences the alarm or it may be disabled by a toggle switch control.



WATER LEVELS are transmitted by coding device ("Telemark"), radio transmitter and time switch

Operating sequence: Weight-driven clock (left) turns on radio tube filaments for one-minute warm-up before second switch starts signals. Signals are determined by position of moving contact arm on ridged disks atop coding device, ridges corresponding to elevation of float resting on surface of water in stilling well. Three disks on this "Telemark" permit measurements to tenths of a foot, total 99.9 ft. Third switch turns off transmitter after predetermined number of sets of signals has been sent.



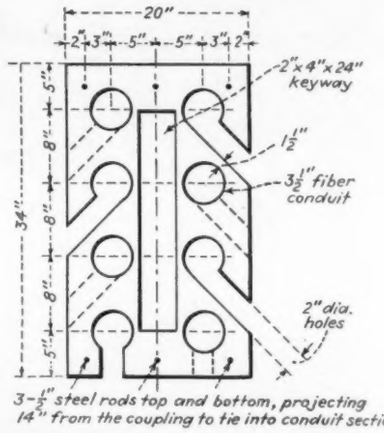
SIGNALS received and recorded by this equipment at distant point from location of measuring and transmitting apparatus

Radio receiver is turned on by electric clock a few minutes ahead of signal-transmission time. First signal actuates receiver relay and starts recorder motor, which runs about 1½ minutes (for one set of signals), then automatically shuts itself off. If signal groups are repeated by coding device, recorder motor continues stepping off sections of tape. At end of transmission period time clock turns off radio receiver, which is normally in use about fifteen minutes of each hourly transmission period.

Underground Lines

Drainage Couplings Obviate Manhole

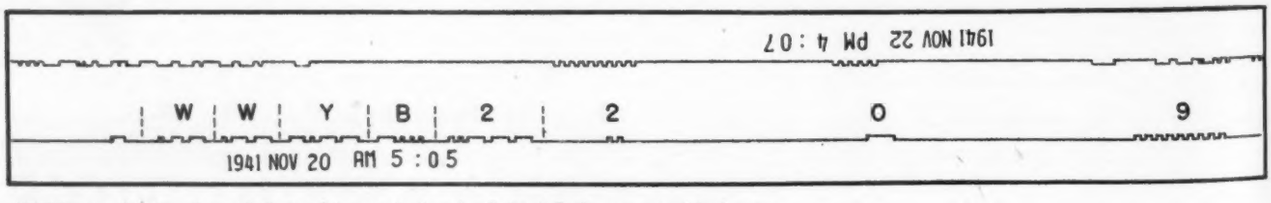
Specially designed drainage couplings for a steeply pitched duct terminating in the switch house of the Wisconsin Electric Power Company


20"
2" 3" 5" 5" 3" 2"
2"x4"x24" keyway
1½"
3½" fiber conduit
34"
8" 8" 8" 5" 5"
2" dia. holes
3-½" steel rods top and bottom, projecting 14" from the coupling to tie into conduit section

UNIQUE drainage coupling for steeply pitched duct line carries surface water away from station; eliminates manhole and sewer connection

have recently been used by this company as a cheaper and better alternative to installation of an 18-ft. deep manhole and sewer connection to carry away surface water. The coupling used is shown in the accompanying drawing. It was used on a recent underground conduit job at Lakeside power plant, where sixteen 3½-in. fibre ducts were brought into the station switch house 18 ft. below grade by tunneling, to avoid obstructions under an adjacent highway.

These ducts were pitched toward the basement and it was anticipated that they would pick up water and



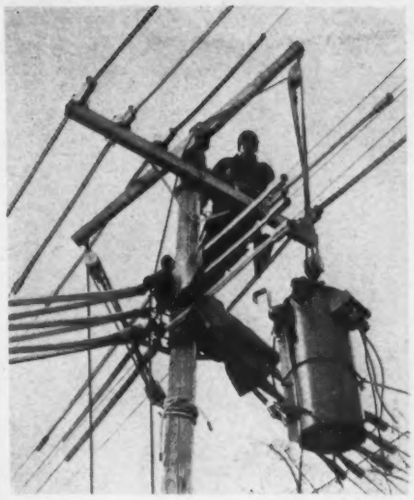
TAPE records signals and time of transmission for later tabular or graphical use

Station call letters are recorded first (in International Morse Code), followed by water level signals—one dot for "1," two dots for "2," etc., and a dash for "0." On accompanying specimen, first dash is not part of signal, but actuates receiver relay to turn on recorder motor. Interpretation: Station WWYB2, river stage, 20.9 ft.

drain it into the basement. The drainage couplings were designed to carry the water away without recourse to a manhole and sewer connection.

Couplings are made of concrete and precast before installation. They were inserted at the end of the conduit run where it entered the building. Each duct was drained through a 2-in. diameter hole from the bottom of each duct to the outside of the coupling. Drain holes were staggered so as to lengthen the path from a cable in one duct to a cable in an adjacent duct to guard against a fault communicating to another cable.

A pocket of gravel was placed outside the coupling to let the water drain down to the building drain tile installed outside the switch house wall. A keyway and six ½-in. steel reinforcing rods were provided to make the precast section an integral part of the rest of the conduit section.



WINCH on truck is used to haul transformer to approximate mounting position. Gin is used to jockey transformer into proper position through hand block and tackle line. Above, close up of gin pole at top of pole shows socket chained to pole and pivot arrangement

Pole Lines

Gin Pole Used to Mount Transformers

The long-standing problem of how to handle pole transformers safely and quickly has been neatly solved by Central New York Power Corporation by a gin pole arrangement developed by Harold Joynt, line foreman at Utica. The gin is pivoted in a socket which has been chained to the pole and it is held rigidly while a truck winch lowers and raises the transformer. With hand lines the transformer can be swung horizontally and moved up and down. The truck winch is used to get the transformer to the proper height. Then through control of the gin by a block-and-tackle hand line the transformer can be jockeyed into position. The device keeps the transformer clear of the pole and makes it easier for the man on top to handle it.

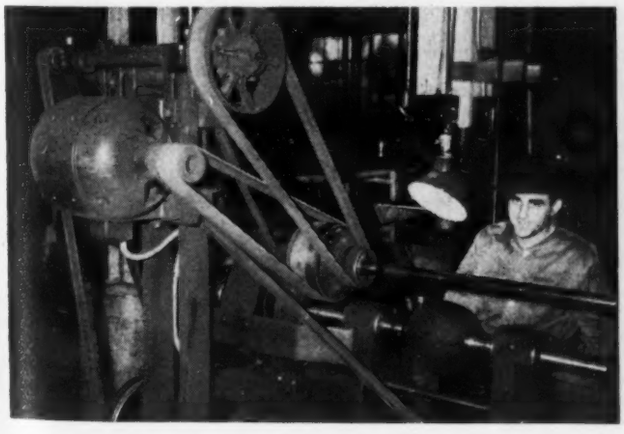
Industrial Power

Individual Motors Drive Ball Lathes

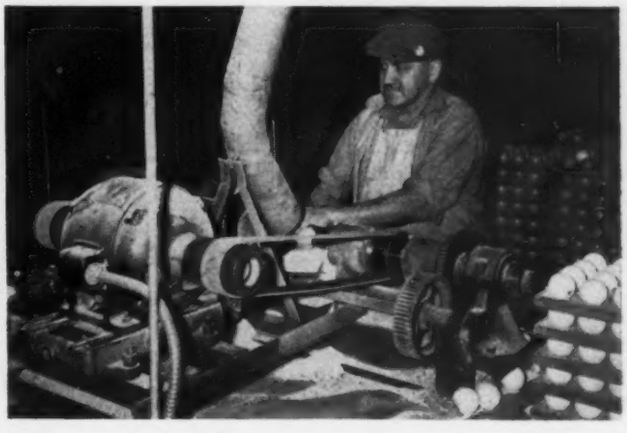
Since the two spindles of billiard and bowling ball turning lathe—unlike wood lathes—must each be positively driven, the application of individual motors to these machines during a recent switch from old-fashioned line shafting at Brunswick-Balke-Collender Company, Muskegon, Mich., offered difficulties.

In the case of the billiard ball lathes, of which there were five, 2-hp., 1,800-r.p.m., single-end motors were converted to double-end drive by welding on a shaft extension, turning the head down in a lathe and adding a second pulley. The motor was mounted on an angle-iron frame bolted to the lathe table.

Bowling ball lathes were arranged, as shown, with a 3-hp., single-end, 220/440-volt motor mounted on channel irons attached to the machine bed. Two jackshafts had to be resorted to in order to secure the proper speed and still drive both spindles from a single-end motor.



INDIVIDUAL MOTOR on special mount replaces line shaft drive for bowling ball lathe

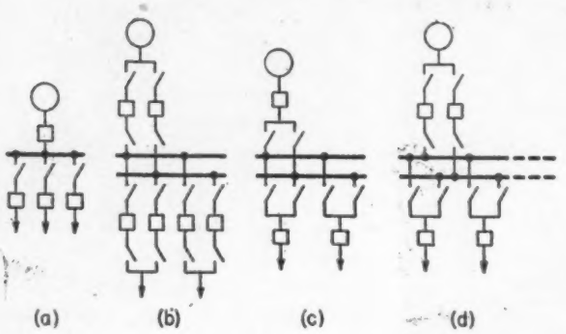


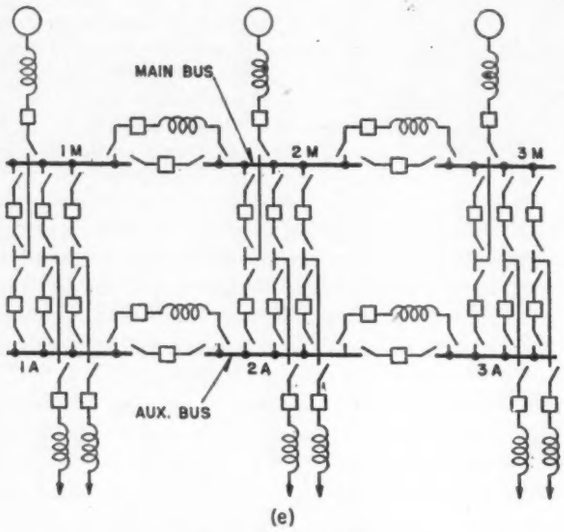
SHAFT EXTENSION adds second pulley end to billiard lathe motor

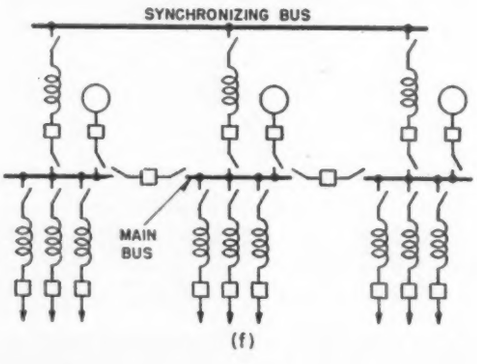
POWER STATION BUS SCHEMES*

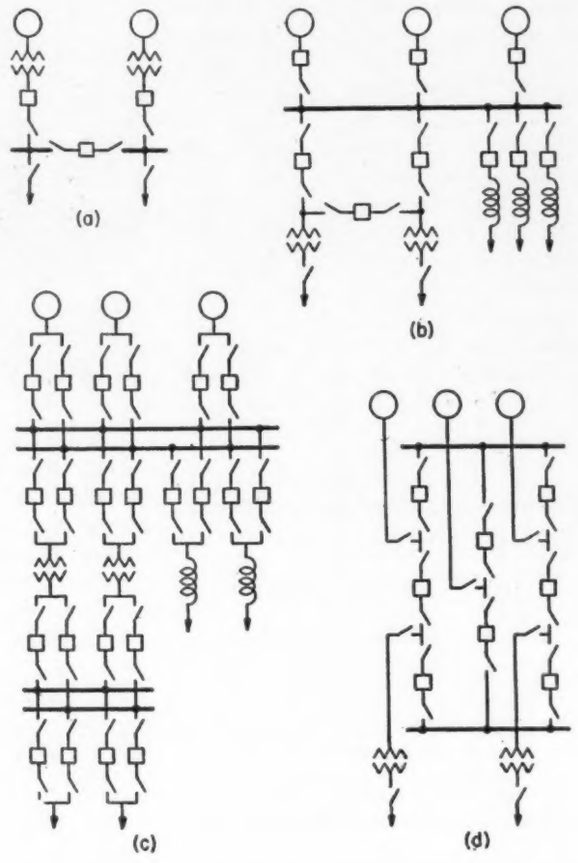
Electrical Layout

By C. A. POWEL
Manager Headquarters Engineering Department,
Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.









1. For stations distributing power at generator voltage.

(a) Single-bus, single-breaker scheme, used only where interruptions to service are relatively unimportant.

(b) Spare-bus double-breaker scheme, utilizing duplicate bus and switching equipment, permitting one breaker or one bus to be removed from service for maintenance without disrupting service to any feeder.

(c) Spare-bus single-breaker scheme, a variation of (b) giving a lesser degree of flexibility.

(d) Spare-bus scheme, another variation of (b), having connections differing in degree of duplication.

(e) Auxiliary-bus scheme, sectionalized bus, utilizing selector breaker (similar to feeder breaker) to connect each feeder to either the main or auxiliary bus and serving as backup protection if feeder breaker does not open in case of a feeder fault, and has current-limiting reactors in series with generators and feeders, and between bus sections. Bus-tie breakers used when one or more generators are out of service to prevent voltage and phase-angle differences between bus sections that would exist if the bus sections were connected through a reactor.

(f) Synchronizing-bus scheme, permits continuous supply to all feeders through reactor ties to a synchronizing bus should a generator fail, also provides a point where tie feeders from other stations can be connected and be available for symmetrical power supply to all feeder buses through the reactors. In this scheme reactors are connected to the bus structure.

2. For stations distributing power at higher than generator voltage.

(a) "Unit" scheme, permits a generator, transformer and transmission line, comprising a unit, to be taken out of service without loosing the load.

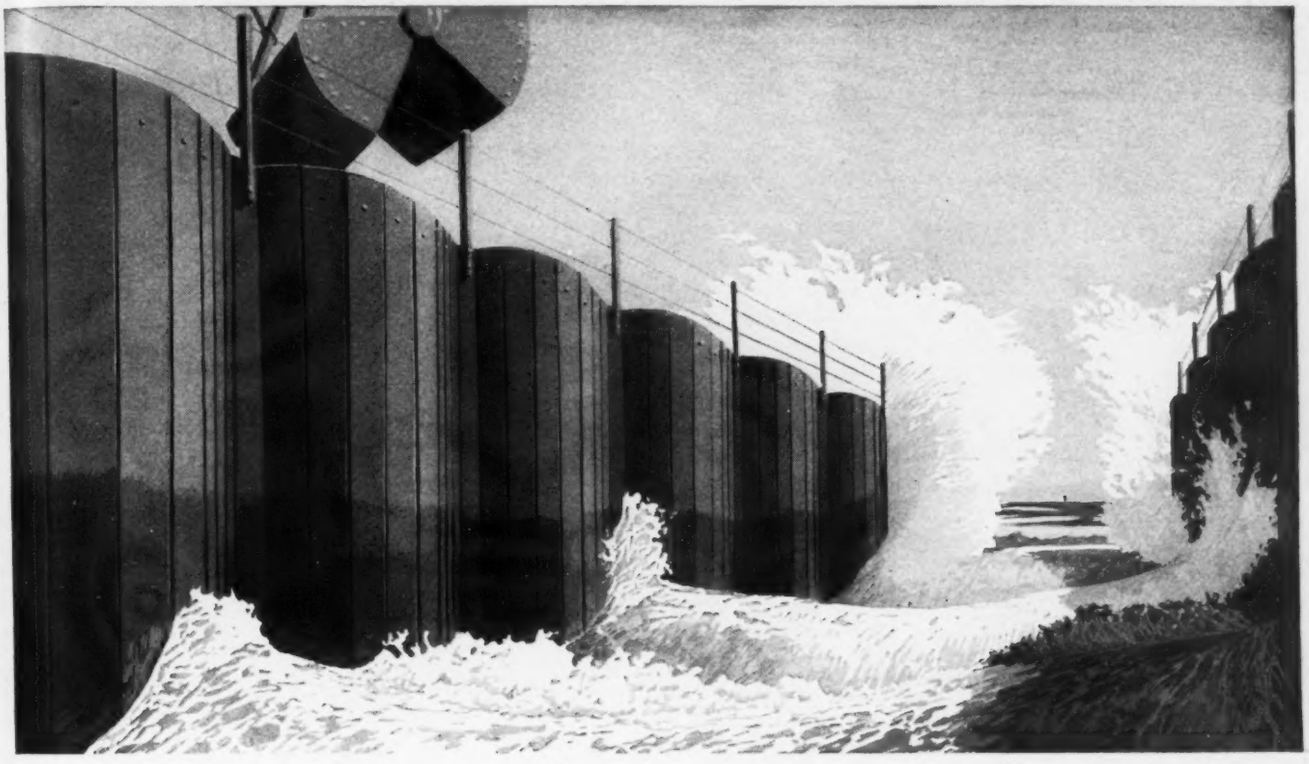
(b) Combination generated- and high-voltage scheme, provides for outgoing feeders at generated voltage and to use an economical transformer size, according to capacity of transmission line.

(c) Low-tension, high-tension, double-bus, double-breaker scheme, utilizing duplicate bus and switching equipment, similar to and giving a greater degree of flexibility than (b), also providing for continuity of service.

(d) Low-tension spare-bus scheme, an arrangement frequently applicable and provides a considerable flexibility with the fewest breakers.

*Extracted from advance pages of "Electrical Transmission and Distribution Reference Book."

AN ELECTRICAL WHOLESALER HELPS SPEED WAR PRODUCTION



WESCO speeded war chemical plant job 59 days

Supplied 15 Types of "Unobtainable" Product in 24 Hours to Prevent Tie-up.

A new plant for making a chemical vital to airplane construction was mushrooming to completion in Texas. Came a day when lack of one electrical product threatened to tie up the job just short of the goal. Manufacturers' best delivery of the critical product was 60 days.

The local WESCO House not only had the particular product in stock but had ample quantities of the 15 different types required. In 24 hours the plant was supplied, work continued without interruption and 59 precious days were saved. Point of the story is this—the WESCO House *anticipated* the need for the item and was ready when the emergency call came.

The ability to anticipate customers' needs has highlighted WESCO'S service for 20 years. For the duration—WESCO'S "know how" is devoted to speeding America's triumph. In the new tomorrow WESCO'S 79 Houses will again serve all business with increased experience and efficiency.

WESCO SPEEDS WAR PRODUCTION

* A plant making explosive compounds received 2-day delivery of explosion-proof condulets and circuit breakers. Without WESCO, a wait of from 8 to 15 weeks would have been necessary.
* Delivery of 68 items necessary to air defense plant was completed in 3 days. Other sources could not even *promise* delivery before 12 weeks.

WESCO SERVES BUSINESS

* By warehousing thousands of items from hundreds of different manufacturers in hundreds of cities.
* By supplementing manufacturers' advertising with own sales promotion efforts.
* By buying large quantities at low prices and passing the savings on to small-quantity buyers.

Westinghouse

ELECTRIC SUPPLY COMPANY

150 VARICK STREET · NEW YORK, N. Y.

The name that means everything in electricity

A NATIONAL DISTRIBUTING ORGANIZATION WITH 79 BRANCHES

Substations

Wooden Substation Saves Steel, Zinc

By H. N. FOX
Commonwealth & Southern Corporation, Jackson, Mich.

Utilization of wood timber to replace galvanized steel shapes in the structure of a medium-voltage outdoor substation has been undertaken on a trial basis at the Black River substation of Consumers Power Company to conserve such critical materials as steel and zinc. This substation comprises three 24-kv. lines and two 3,000-kva., 24,000-7,500/12,000-volt, three-phase transformers.

Although the wood structure was adopted principally to see what could be developed as a substitute for critical metals, it was found that the material in the structure could be delivered to the job for about 70 to 80 percent of the cost of steel. Of course this will vary with the design and details and principally with the voltage of the station. On low-voltage structures of approximately 15 kv. the wood tends to approach the cost of steel and advantage in cost increases with the voltage. The structural wood substation will have a decided advantage in areas where galvanizing deteriorates rapidly as it will eliminate the repainting required on galvanized structures. There may be a limit to the voltage that can be adapted to wood structures of this type due to spans required and at the same time show a financial saving. It is expected that life will be 25 to 30 years and probably more.

The complete structure is arranged similarly to a conventional steel structure, with concrete footing, fabricated wood trusses, etc. Columns are attached to concrete footings by steel channels and anchor bolts. Unlike many former designs embodying wood poles and bolted timbers, this design is as salvageable as a steel structure. Design loadings are the same as for the steel structure it replaces, but it provides a more rigid structure.

Wood used is a select structural grade Douglas fir, completely detailed as with a steel structure and completely fabricated at the shop with steel plates and fittings for joints and attachments. Strength and rigidity of the structure depend largely on proper design of these joining members and attachments. Attachment and fittings for the Black River structure were a standard design.

After fabrication timbers were treated with the new Pentachlorphenol treatment and an inexpensive tool using a Zerk gun was designed for pressure treating any field holes that were necessary. Since trusses and units were shop-assembled as far as possible, some small saving was made in field assembly as compared with steel structures of the same size.

A new substation fabricated but not erected employs timber rings, shear plates and connecting fittings designed to reduce somewhat the quantity of steel and wood required. This results in a "lapped" type of joint as compared with a "butted" type of joint used at Black River and more than likely will not present quite as neat an appearance.

Line Engineering

Simple Method for Figuring Copper Loss

By B. E. ELLSWORTH
North Platte, Neb.

Copper and core losses in lines and transformers calculated for billing purposes should be reasonably accurate. A simple method for determining copper losses is here presented, which has been found quite accurate for loss studies involving equipment on one particular utility system. As core loss is a constant it will not be considered here.

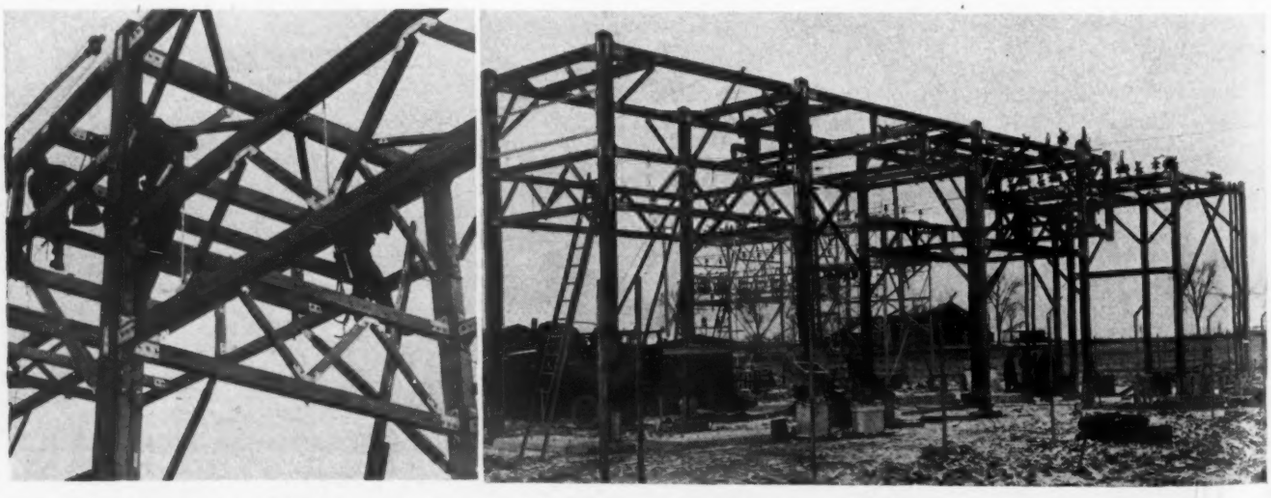
Copper loss in any circuit is the familiar I^2R. There are several ways of expressing this loss; the most simple is to figure full copper loss for some definite number of hours a day.

Take several load curves applying to the circuit or system in question having different load factors so they represent the type of load supplied. For each curve square the current values and take the average of I^2 for each curve. This value represents the heating value or loss for the curve. This value divided by the square of the maximum current is called the loss factor.

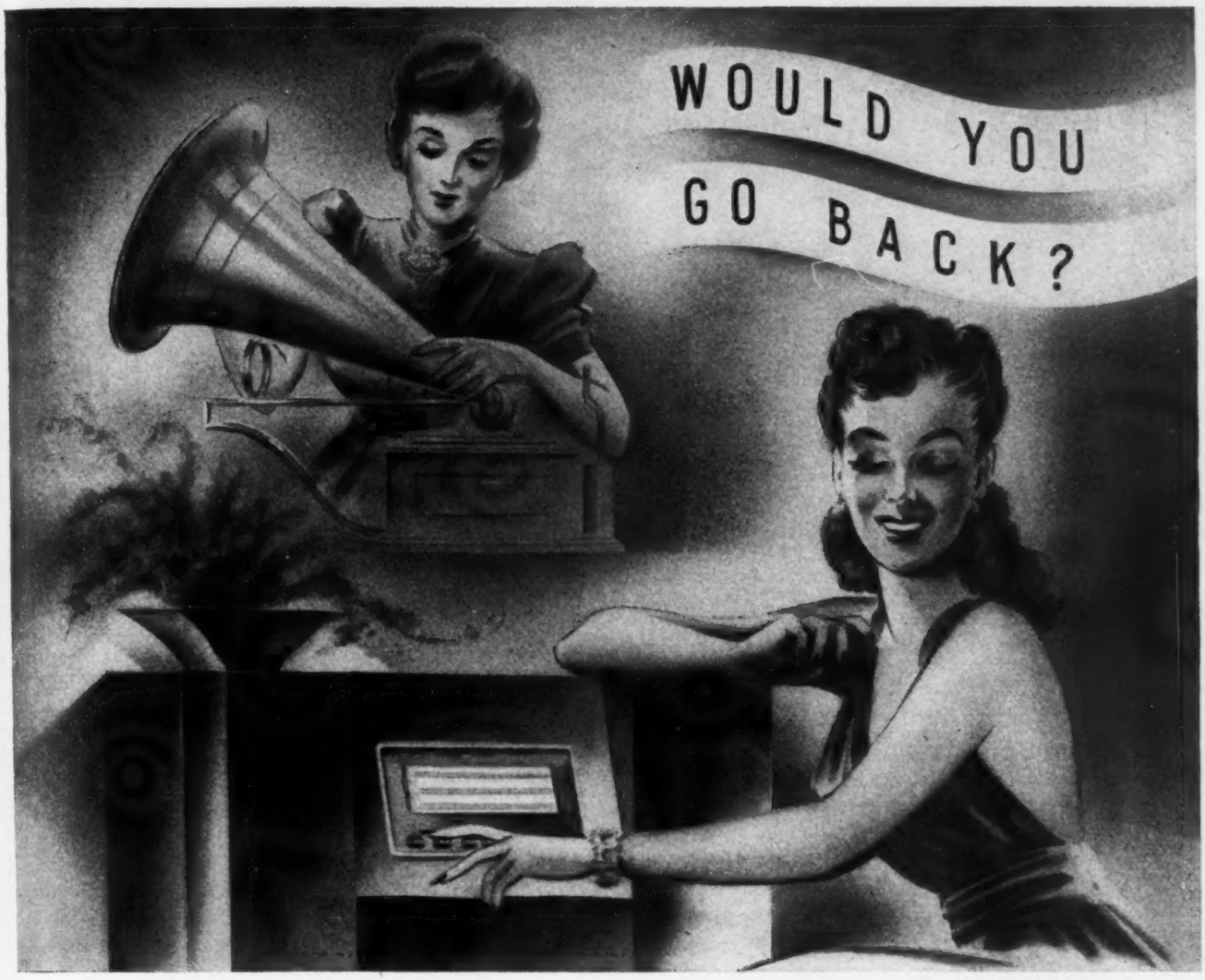
If the maximum or peak current lasted all day it is quite evident that the maximum copper loss would be applied 24 hours of the day. For a given load curve

$$\frac{I^2 \text{ average}}{I^2 \text{ maximum}} \times 24 = \text{hours to apply max. loss.}$$

The copper loss for a curve of given shape has a definite relation to



CLOSE-UP of impregnated Douglas fir substation of Consumers Power Company (left). General view of wooden substation structure of 5½ x 9-in. main members (right).



A BETTERMENT . . .

Not a Substitute

Push a button and you have world events before you . . . Flick a switch and you hear the best music of the ages—automatically played from a dozen recordings. Would you call the modern Radio-Phonograph Console a substitute for the gramophone of only a generation ago? Would you want to go back to the gramophone of Grandma's day?

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C-D NON-metallics inherently possess unique characteristic combinations. VULCOID, for example, combines the strength, resiliency and machinability of Vulcanized Fibre . . . with the moisture resistance ability of laminated plastics . . . and the electrical insulating properties of both. The other four C-D NON-metallics possess equally advantageous characteristic combinations. Booklet GF-9 describes all of them. Send for it today.

When you are ready to discuss your specific "What Material?" problem, write, phone or wire for a C-D Laboratory Research Representative. He'll help you find the answer to product, process or performance BETTERMENT.

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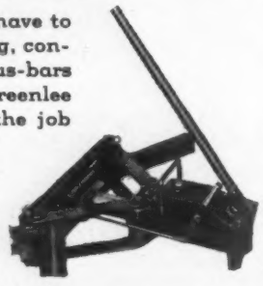
GET *Extra* MAN POWER with GREENLEE BENDERS

- EASIER AND FASTER
- ONLY ONE MAN TO OPERATE
- LIGHT, PORTABLE, EASY TO SET UP
- POWER TO BEND 1¼" TO 4½" PIPE
- SAVE COST OF MANUFACTURED BENDS
- MAKE SMOOTH, EVEN BENDS

As good man power becomes scarcer in the present emergency, increase the efficiency of your men by turning to a better use of tools. Let Greenlee Benders help you speed up construction by making the work easier and faster for the man on the job. Greenlee Benders are daily saving contractors on defense jobs from 15 to 75% in time and labor costs.

There's a Greenlee Bender For Every Job

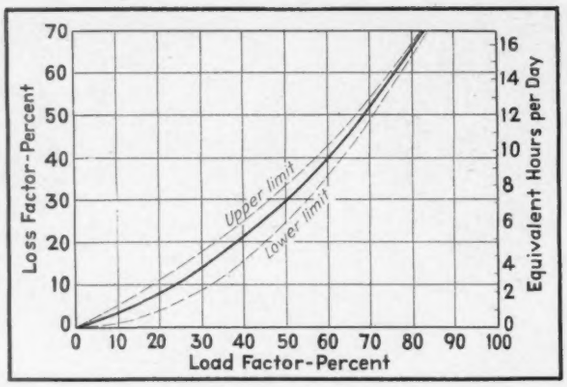


Whatever you have to bend . . . tubing, conduit, pipe or bus-bars . . . there is a Greenlee Bender to do the job easier and faster. Small hand benders will bend copper tubing from ⅜ to 1⅛ inches and steel, copper, brass, and aluminum tubing from ¼ to ¾ inches. Powerful Greenlee Hydraulic Benders are available for bending 1¼ to 2-inch thin-wall conduit, 1¼ to 4½-inch rigid conduit and pipe, and for bus-bar up to 4 inches wide and ¾ inches thick.

These benders are all readily portable, easy for one man to operate, make smooth, even bends without distortion, and eliminate the need for many costly fittings and manufactured bends. Find out how Greenlee Benders can save vital hours on your defense jobs . . . write for Bender Booklet S-116.

Greenlee TOOL CO.

1804 Columbia Avenue, Rockford, Illinois


Loss Factor-Percent
Equivalent Hours per Day
Load Factor-Percent
Upper limit
Lower limit
0 10 20 30 40 50 60 70
0 2 4 6 8 10 12 14 16
0 10 20 30 40 50 60 70 80 90 100

COPPER LOSS has definite relation to load factor for load curve of given shape. Range of loss factor for different load curves has definite limits. Graph (left) compiled from a number of system load curves gives loss factor with reasonable accuracy.

load factor. This relation changes as the shape of the load curve changes; however, there is a limit beyond which the loss curve will not fall.

The accompanying curve was calculated from a number of system load curves. It has been found quite accurate. If desired, the loss factor may be used on a daily, monthly or yearly basis. The hours per day, of course, apply only to a daily curve. The dashed lines show the upper and lower limits between which the curve will be located.

Stores

Private Storerooms Help Line Crews

It used to be that early in the morning at the line storeroom of Rockland Light & Power at West Nyack, N. Y., was a somewhat hectic period, with some line trucks still around the place at 8:45 a.m.

Now, due to a private storeroom plan, all the trucks are gone at 8:15 a.m., confusion has disappeared, line foremen don't need to be skilled accountants and arguments have almost vanished as to who is charged with certain materials and supplies.

The heart of the plan, as described by R. L. & P. General Foreman Smith, is a strictly private storeroom under lock and key for the personal convenience of each line crew foreman. Seven of these private storerooms are shown in the photo and the section marked by the arrows is the storeroom which belongs to line truck 54.

The way the plan works is that all the preliminary work is done during the day while the trucks are out. Suppose a two-pole line extension is to be made. When the work order gets clearance to the distribution department, an estimator makes up the sketch and prepares the exact bill of materials or stock sheet for that particular job.

With Mr. Smith's and other proper

OUT early in the morning and no mixed up materials.

Rockland Light & Power provides a private storeroom for each line truck. Arrows mark storeroom for truck 54. Storekeeper deposits materials and work orders in here during the day, unlocking the "back" door. The locked "front" door—the key is carried by foreman on truck 54—opens up onto loading platform and garage stall for truck 54.

Lighting and Power Circuits for research at Bell Telephone Laboratories protected by

HEINEMANN CIRCUIT BREAKERS

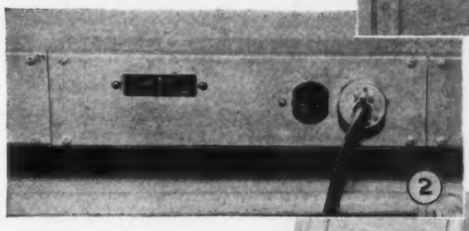
Where a diligent and never-ending search for new facts, figures and principles is a business, HEINEMANN ***Fully Electro-Magnetic*** Circuit Breakers were selected for the important job of protecting power and lighting circuits. That is a tribute to the efficiency of Heinemann devices which open instantly on short circuits and dangerous overloads but permit harmless overloads of short duration.

1 THREE POLE BREAKERS—Also available in single and two pole types with instantaneous trip or magnetic time delay. Ratings are from 50 milliamps. to 50 amps. on circuits up to 460 volts AC or 250 volts DC. Four different time delay curves to match characteristics of almost any circuit.

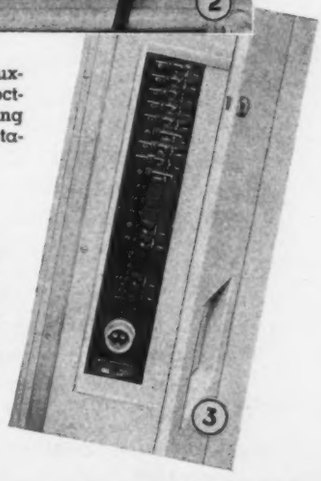
2 AUXILIARY BREAKER—Outstanding for protection of fractional hp. motors. Ratings are from 250 milliamps. to 35 amps.

3 *"MAGNETTE"* PANELBOARD BREAKER — These are furnished for assembly in lighting panelboards and made in ratings up to 50 amps. Their current carrying capacity is not affected by changes in temperature.

Three Pole, Three Coil Breaker, with auxiliary shunt trip for remote control operation, protects power circuits. Remote control switch (at right) operates shunt trip. Sufficient current flows through shunt trip to neon light to show current is on. When breaker trips, light goes out.



Bus duct showing Auxiliary Breaker protecting circuits serving duplex 3 point receptacles.



Panelboard for lighting circuits showing *"MAGNETTE"* Panelboard breakers with locking devices to prevent tampering by unauthorized persons.

Send for Catalog 40 Showing Complete Line

HEINEMANN CIRCUIT BREAKER CO.,

SUBSIDIARY OF HEINEMANN ELECTRIC CO.

103 PLUM STREET *Established 1888* **TRENTON, N. J.**

So much for so little

• For an expenditure averaging $1000 a mile along 200 miles of hazardous American highways, several communities experimenting with improved night lighting during the past 4 years have experienced—195 fewer traffic deaths, 3,474 fewer traffic injuries, 7,304 fewer property damages and a savings of $5,891,000 in accident costs. This test of adequate street and highway lighting proves that in no phase of traffic accident prevention can so many be indebted for so much—for so little!

Slater Lamps are contributing to such night safety and greater maintenance savings on hundreds of miles of modern American highways. There's a reason for cities from Portland, Oregon to Providence, Rhode Island using Slater Lamps for traffic lights, street lighting, fire alarms and other municipal highway uses—these durable Slater Lamps are economical in cost, and high in lighting efficiency—they deliver more lumens per square foot at less cost. Interstate Avenue in Portland, Oregon, shown above, is flooded with light from Slater Lamps.

We'd like to tell you the HOW and WHY story about the savings you can effect by using Slater Lamps. Send today for all the details.

LET US HELP YOU WITH THE SOLUTION OF YOUR LIGHTING PROBLEM
Send for complete information.

"Slater Lamps Scintillate"

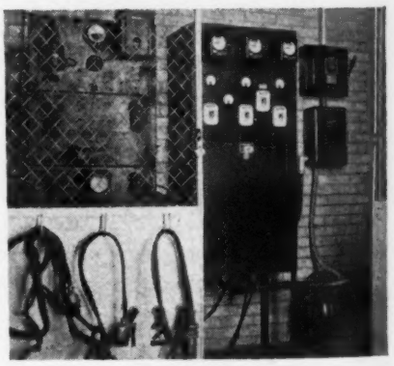
Slater Electric & Mfg. Co., Inc.
Manufacturers of Street Lighting Lamps
728 ATLANTIC AVENUE BROOKLYN, N. Y.

approvals the work order is assigned to one of the seven line crews and sent downstairs to the storekeeper. The storekeeper makes up the material and, if the job has been assigned to the crew on line truck 54, the storekeeper unlocks the back door of the private storeroom, places the material inside with the order, sketch and list of materials and then locks the door. Nobody else can get into the private storeroom except the boys on truck 54. When they come in at night they back truck 54 into a stall, which is also its garage, and the rear end of the truck is but a few feet away from the front door of the private storeroom.

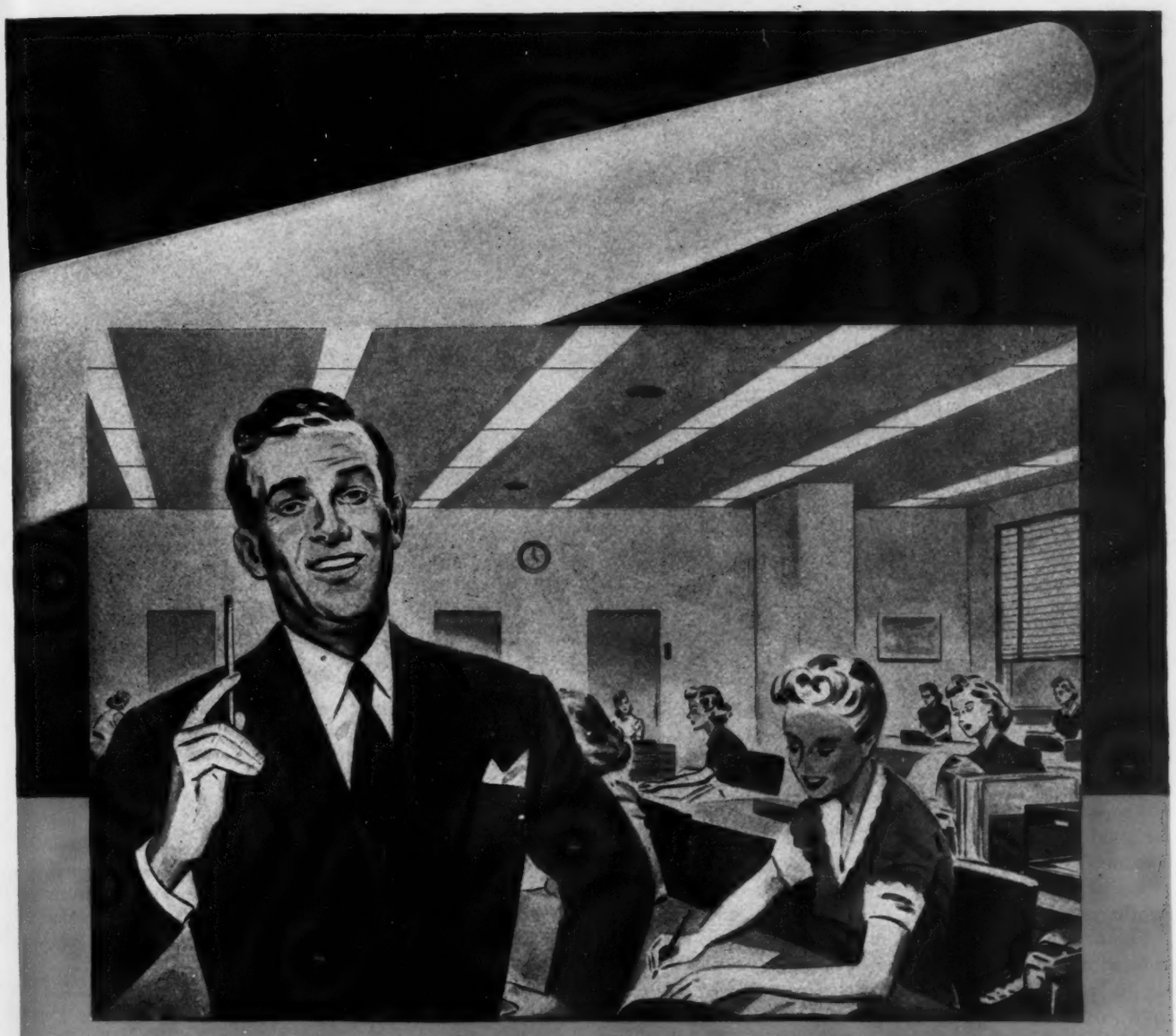
Unlocking the front door the crew returns unused and salvaged materials, with the official papers. On the floor, assembled for each job and ready for loading, are tomorrow's materials with their respective work orders.

Industrial Power

Charging Station for Truck Batteries



Batteries of three material-handling trucks can be simultaneously and automatically charged at the Indianapolis plant of Marmon-Herrington from this point near the production floor by connecting them to cables emerging from the safety inclosure. Desired ampere-hour charge is set on meters in each battery circuit and when that charge has been delivered breakers automatically remove the battery from the charging circuit. The charging rate is fixed. D.c. supply for charging is supplied from a motor-generator set capable of delivering 252/140 amp. d.c. at 38 volts. Truck batteries have a 300 ampere-hour capacity.



Better light for better sight more important than ever

The story of better light for better sight is now more important than ever before. You and Westinghouse know that workers need good lighting to operate lathes, drill presses, and milling machines at peak efficiency. We know too, that good lighting helps men and women work faster and more accurately. We know good lighting reduces accidents and fatigue, minimizes rejects and spoilage.

Together we can bring these and many other advantages of better light to your customers. We can help your customers make lighting one of their most efficient production tools. And Westinghouse will use its engineering, manufacturing, and research facilities to provide the Westinghouse Mazda Fluorescent Lamps that are unsurpassed in quality and dependability. Westinghouse Electric and Manufacturing Company, Lamp Division, Bloomfield, New Jersey.

For More Top-Quality Lighting Installations—

Westinghouse MAZDA FLUORESCENT LAMPS

LOAD BUILDING

Better Light for Barbering

By MARY SHOOP
Southern California Edison Company

A combination of fluorescent angle wall reflectors and incandescent ceiling units provides good lighting at Jackson's barber shop, Alhambra, Calif. Designed by Willard Bausman, Southern California Edison Company lighting engineer, and installed by Lloyd R. McCauley, the system fulfills a particular lighting requirement for good tonsorial work—light at the customer's temples and at the back of his head. With ordinary overhead lighting, these areas are in shadow.

The shop is 33 ft. long, 16 ft. 6 in. wide, with 11-ft. 6-in. ceiling. The ceiling and upper walls are light ivory in color, with yellow paint being used on lower wall surfaces. Three Lumidor W-245 angle reflectors, each using two 40-watt white fluorescent lamps, are mounted 7 ft. high on the walls, 5 ft. from the head of the chairs. Four general suspension type Solar direct-light open opal reflectors with 200-watt incandescent lamps are mounted on the ceiling.

The lighting produced 40 ft.-candles of initial lumination at the back of the chairs, with 32 ft.-candles maintained after eight months of use.

Garold Jackson, proprietor of the four-chair shop, traced about 100 new customers to the lighting in the first month after its installation. Although many of them had passed the shop regularly, they had not given it special attention until its enlargement and modernization. In addition to increasing business and contributing quality work, the lighting has made a valuable improvement in visual comfort, Mr. Jackson says. Tired eyes at the end of the day are a thing of the past for him and his employees.

WALL-MOUNTED fluorescents light the back of the neck

Lighting Sold in Tailor-Made Package

By BENTLEY BARNABAS
Sales Promotion and Advertising Manager
Kansas Gas & Electric Company, Wichita

Although Kansas Gas & Electric Company is not now engaged in any selling activities and probably will not be until the end of the war and the campaign described here terminated before the outbreak of hostilities, it appears at this writing that regular supplies of lamps will not be substantially curtailed. It seems that utilities as a result may expect to continue to build load and revenue through lighting campaigns. Therefore this article may contain points of interest to sales executives planning 1942 lighting campaigns.

For many moons utility sales executives have agreed that the way to sell lighting is to sell it *big*. "Even a peanut vendor sells his peanuts by the sack instead of one at a time!" Get good lighting in every room in the home, at every working center—that's the way kilowatt-hours can be sold in worth-while quantity. We've known *what* we wanted for a long time. *How to get it* was the question!

Kansas Gas & Electric Company set out to do something about selling light conditioning *big* when 1941's fall lighting season rolled around: "Let's make the elements of Better-Light for Better-Sight a unit, a single thing that can be sold, advertised, talked about." "Let's wrap it up," they said.

Lighting packages which had been so well worked out by other companies were examined, but they had one weakness—they were inflexible. If the customer didn't need all that was in

★

"We've taken on a bigger job now than supplying lamps"

A statement about the lighting situation of interest to every utility executive

As more and more plants in America start running multiple shifts seven days a week, the question of lighting for production becomes more and more serious. Unfortunately most industrial lighting simply is not geared for high-speed production. The average, as a matter of fact, is much less than is needed for the job that must be done. And this is especially true in thousands of smaller plants which have been converted to war work. Because the converted plant can be the bottleneck which holds up the completed production of war materials somewhere else.

We realize, as you do, that because of shortages on critical materials . . . because of the shortness of time . . . there is no possibility of relighting the twenty-five or thirty thousand plants in this important group.

But we believe that if we in the electrical industry will tackle the job, we can measurably improve the lighting, and through that, the production in these countless smaller factories. Here are the sort of things that need not involve any quantity of critical materials, yet can make a significant difference in the lighting of almost any plant:

1. Soap and water — on a *regular* cleaning schedule.
2. Right size bulbs in present fixtures.
3. Reallocation of present lighting to fit new demands.
4. Supplementary lighting—for the most critical seeing operations, such as inspections.
5. Light colored walls to reduce light absorption; light colored finishes on machinery to increase visibility.
6. New incandescent or fluorescent installations, *only if these other methods are inadequate.*
7. Frequent light meter checks on maintenance.

Isn't this a program in which we can all unite . . . utilities, manufacturers, jobbers? Is there any better way for us to turn our man-power into bombers and tanks and ships than to open up some of the bottlenecks that are holding back our war effort?

We realize, as you do, that time is tragically short.

G-E MAZDA LAMPS

GENERAL ELECTRIC

TAILOR-MADE light-conditioning package with elements that make up the unit, grouped around it

the package or if he needed more—he was stuck

A *tailor-made package* appeared to be the answer, but the job looked tough at first. How could a package be made *that* adaptable? How could such a package be handled? Nevertheless the idea was given the executive green light and the company's fall campaign was built around a light-conditioning package housed in the paperboard box shown.

Two sizes were used, the large one was 30 in. high and the small one 20 in. high. Side dimensions were 20 x 20 in. The box accommodated everything but the larger lamp bases —giving protection to delicate shades and to lamp bulbs. Adaptors fit into the boxes while still nestled comfortably in their own packing cases.

Campaign advertising urged customers to buy the package complete. It was made clear what elements of complete light conditioning would be placed in each customer's package and what each element—bulbs, adaptors, pin-it-ups and portable lamps—contributed toward Better-Light for Better-Sight. Six three-column fifteen-inch ads were carried on the package throughout the campaign, along with four other ads of the same size that did not emphasize the package as heavily.

Salesmen used the demonstration principle, offering to install the complete package on trial. Men who made the best showings encouraged the customer to "try out" a maximum rather than a minimum of good light. Many more large sales resulted than in previous campaigns and the level of each sale was far higher than it had been in previous years.

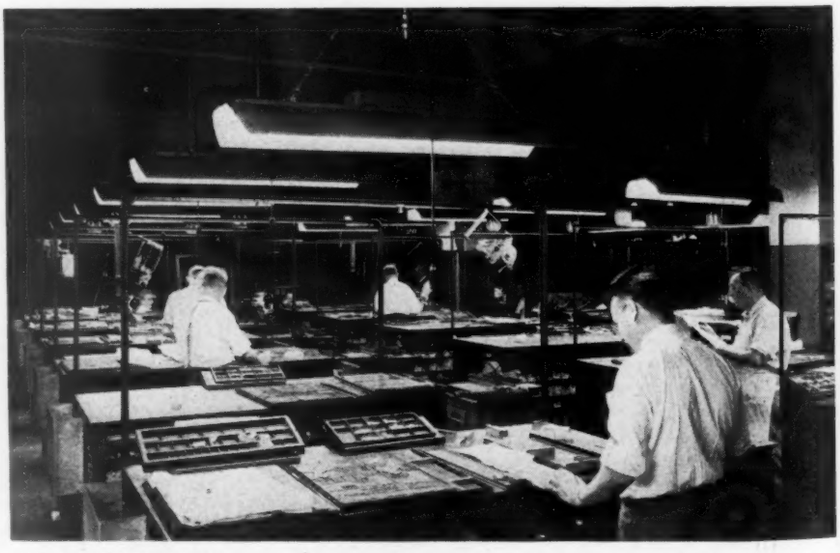
Salesmen sold 851 portable lamps, 642 pin-it-up lamps, 3,429 screw-in adaptors and 1,456 silver bowl bulbs. All quotas were exceeded.

Biggest contribution of the package-selling idea, in the words of General Sales Manager Sam Brolund, was: "... to make us think big and to make our customers think big about lighting. This campaign, which sold over 500,000 watts of increased lighting service, was the best we had ever had. I think it was more productive of revenue on a basis of the wattage sold than any previous campaign, although there's no way to prove that. But we got rid of our fear of trying to sell a lot of lighting in one sales call. When times get ripe for another lighting campaign we're going to tackle it with the idea that light conditioning is a major service in the home if you sell it right—sell it *complete*. The package had more to do with changing our frame of mind and, through advertising, changing the customer's frame of mind than anything we have done so far."

•

Eyesight Conserved in Composing Room

By installing 162 100-watt Hygrade "Miralumes" in its composing room the Boston *Herald-Traveler* has modernized this vital part of its plant, giving an initial intensity of 75 ft.-candles on the stones from units mounted 48 in. above, and a maintained intensity of about 55 ft.-candles. The former intensity was 20 to 30 ft.-candles, using a combination of tungsten and mercury-vapor units. In the new layout outlet tees are provided on 5 x 10-ft. centers for maximum flexibility, using $\frac{3}{4}$-in. overhead rigid conduit. The new daylight lamps give virtually no shadows, and the uniformity of the light has resulted in greatly reduced eye strain, fewer errors in composition, and cooler operating conditions particularly useful in meeting deadlines.



EVEN ILLUMINATION on the stones, maintained intensity 55 foot-candles

FOLLOW THIS FLEUR-O-LIER GUIDE TO *Extra Value* IN FLUORESCENT LIGHTING

WHAT CUSTOMERS GET		WHAT IT MEANS TO THEM
They get fluorescent lighting fixtures made to fifty definite specifications set up by MAZDA lamp manufacturers to assure top-notch performance and service. These cover fixtures, starters and ballasts.	**1** **Fixtures built to definite standards**	This label means assurance of high quality equipment . . . built to serve dependably for the long pull ahead; and it means getting the most from their lamps.
They get fixtures certified as meeting these important specifications by thorough test of impartial experts . . . famous Electrical Testing Laboratories, New York.	**2** **Testing and certification**	This label saves time for their purchasing department. Tests you might expect them to make have already been made by independent experts.
They get *Certified* ballasts and starters—vital to efficient operation. No fixture can be dependable without positive check on this important control equipment.	**3** **Certified ballasts and starters**	This label means efficient operation and efficient use of the wiring system. This is especially important with today's demand on electric power.
They get fixtures Certified on all other important features they want and should have for a satisfactory lighting job: highly efficient lighting performance; durability and safety; ease of maintenance; high power factor (over 85%); flicker correction; the right ventilation for most light from their lamps.	**4** **Features they want CERTIFIED**	This label means assurance of dependable trouble-free operation, performance that won't let them down now when time is short and every hour counts. It means assurance of lasting service, so important at a time when replacements are increasingly difficult to secure.
Fleur-O-Liers are made by over 35 leading fixture manufacturers. Result: types, sizes and styles to fit any industrial or office need. And every unit carries the Fleur-O-Lier Manufacturer's guarantee!	**5** **Choice to fit needs**	This means choice enough to fit the requirements of any lighting job; greater availability, faster service on fixtures built to definite standards.

Dominating National Advertising reaches your customers through SATURDAY EVENING POST, TIME, NEWSWEEK, and leading trade and business publications. Tells them to plan Fleur-O-Lier installations through their electric service company. Take full advantage of it!

Send for free copy of booklet "50 Standards for Satisfaction"—full of important information together with list of Certified Fleur-O-Lier Manufacturers. Use coupon below.

You may get some of these important advantages in other fixtures
YOU CAN BE SURE OF THEM ALL IN FLEUR-O-LIERS

CERTIFIED FIXTURES FOR FLUORESCENT LIGHTING
who complies with FLEUR-O-LIER requirements

TEAR OUT AND MAIL

Fleur-O-Lier Manufacturers ; 2126-4 Keith Building, Cleveland, Ohio

Please send me FREE new booklet "50 Standards for Satisfaction," together with list of Fleur-O-Lier manufacturers.

Name _____

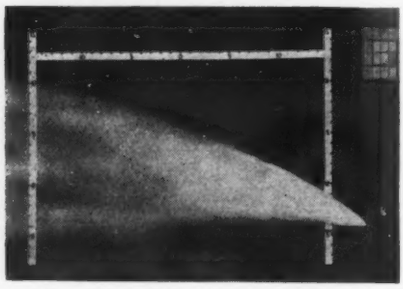
Address _____

City _____ State _____

NEW EQUIPMENT

Fire Protection

To combat fire hazards of incendiary bombs, flammable liquids and certain types of electrical equipment, a new type of metal nozzle has been developed for converting plain water into a combination high and low velocity spray. This "waterfog" is said to have low conductivity. Extinguishing action is claimed to begin at 30 lb. and reach maximum projection and effectiveness at pressures beyond 100 lb. per sq.in.

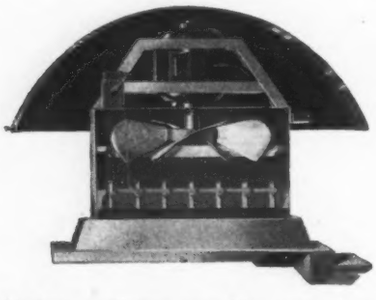


Type "N-20" WaterFog nozzles; sizes for 1, 1½ and 2½-in. hose lines or play pipes, respective discharge 25, 105 and 200 g.p.m. and waterfog pattern projecting approximately 30, 40 and 50 ft. from nozzle, at 100 lb. pressure. **Rockwood Sprinkler Co.**, 38 Harlow St., Worcester, Mass.

•

Ventilators

To meet conditions imposed by a blackout, three basic models of ventilators have been developed to be light-proof as well as weatherproof. Summer supply unit is designed to provide large volume of outside air with perceptible air motion. Exhaust unit is merely an exhaust fan to remove air in occupied areas of buildings. Winter supply unit contains heating coils, face and bypass dampers, and a propeller fan. Maintenance can be accomplished from rooftop; hood hinges upward.



Blackout ventilators; capacities range from 1,500 to 20,000 cfm., motors ⅛ to 5 hp. **The Trane Company**, La Crosse, Wis.

•

Glass Protector

"Roxaneal;" glass protective coating; available in clear, transparent form, also in blackout type. **Roxalin Flexible Finishes, Inc.** Elizabeth, N. J.

A liquid coating applied to plain glass is said to prevent broken glass from flying, due to concussion and vibration during air raids. It is not claimed to stop glass from fracturing, but, according to test, will keep broken glass in place, thus preventing dangerous flying splinters. The liquid is brushed on interior of clean glass. Windows may be cleaned with mild soap solutions without affecting strength of the protective film. It may be peeled off with a razor blade or washed off with solvents.

•

Blackout Control

New series-multiple relay is available to provide a means whereby a series street-lighting circuit can control another series circuit or any nearby multiple circuit, for normal or blackout control. It consists of an a.c. contactor mounted on and connected to secondary of a Type IL transformer.

Type "RIL" Novalux series-multiple relay. **General Electric Co.**, Schenectady, N. Y.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

Fresnel Luminaires

For lighting industrial fences and areas for protection against sabotage, Fresnel luminaires are provided with cast iron hoods, lower part of which has a flange for watershed and breather to avoid creation of a vacuum due to sudden cooling of luminaire by rain. Felt gaskets form a weatherproof and bugproof seal between hood and reflector.

Types "SF-180" and "MF-180" **Fresnel luminaire**; for series and multiple circuits respectively, arranged for pole and building wall mounting. **Westinghouse Lighting Division**, Cleveland, Ohio.

•

Insulation

Arc resistant laminated insulating material; paper, canvas, muslin, and Fiberglas base grades; sheet, tube and rod forms. **Formica Insulation Co.**, Cincinnati, Ohio.

New type of laminated insulation is made of recently developed materials which shows under A.S.T.M. test, D-495-41, approximately ten times the arc resistance that has been available in laminated insulating material heretofore, it is claimed.

•

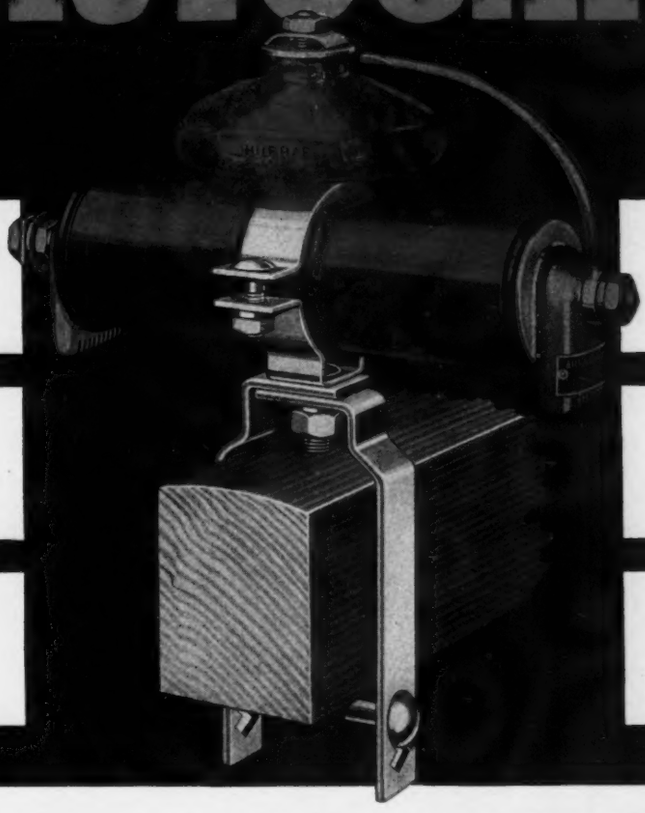
Fire Extinguisher

"duMag" dry extinguishing compound; available in 45-lb. pails and 12-lb. tubular containers. **Dugas Engineering Corp.**, Marinette, Wisconsin.

Power developed specifically for extinguishing magnesium and incendiary bomb fires has these claimed advantages over salt and sand: Takes less to put out the fire; is moisture resistant; remains free-flowing; is non-abrasive; will not react

LIGHTNING PROTECTION

WITH AUTOGAP ARRESTERS



RELIABLE CO-ORDINATED LIGHTNING PROTECTION

SAFEGUARD YOUR MOST TROUBLESOME SPOTS

EXTREMELY HIGH SURGE CAPACITY

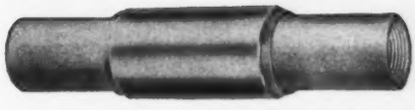
WILL NOT LOCK OUT FEEDERS

WEATHERPROOF— UNAFFECTED BY SLEET OR SNOW

MOUNTINGS FOR POLES, TRANSFORMERS OR CROSSARMS

LIKE A GUN BARREL

Steel-Reinforced to Withstand DISCHARGE



The Hubbard Autogap Arrester, on the market and available for the short span of two years, has already demonstrated its superiority. Installed, deliberately in troublesome spots, this arrester has solved the Lightning problem of a large number of users throughout the United States.

"Hang the Load on Hubbard Hardware"

Stock No.	Phase to Phase Circuit Voltage				Max. Arrester Voltage Rating	60 Cycle Test Value Kv. Rms.	Min. Impulse Breakdown Voltage 1½-Kv. Crest 40 Micro-Seconds	Weights	
	Ungrounded		Grounded					Net	Shipping
	Min.	Max.	Min.	Max.					
2300	1000	3000	1000	5000	3000	19	30	8 lbs. 3 oz.	10 lbs.
2301	3000	6000	5000	9000	6000	25	40	9 lbs. 11 oz.	10 lbs.
2302	6000	9000	9000	13800	9000	32	60	9 lbs. 11 oz.	11 lbs.

HUBBARD AND COMPANY

PITTSBURGH . . . OAKLAND CALIFORNIA . . . CHICAGO

PROTECT AGAINST CORROSION-

AND ACCIDENTAL CONTACT

. . . . . WITH

ROEBLING

URC TYPE WEATHERPROOF

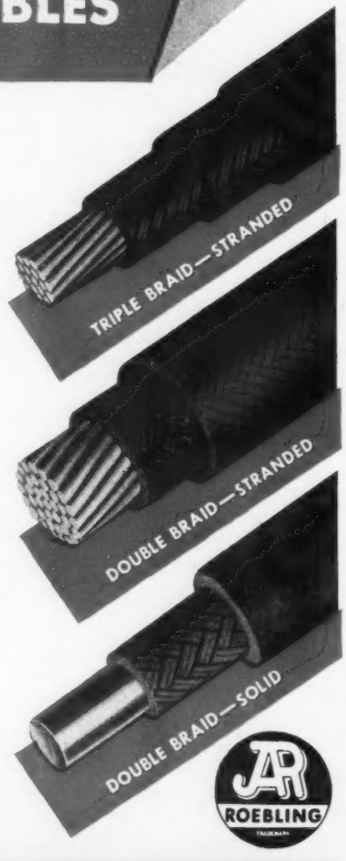
WIRES AND CABLES

ASA STANDARD

To avoid costly interruptions in electric service, linemen today must handle a lot of jobs—such as repairing broken lines, tapping new extensions—while the lines are "hot". To provide protection against corrosion and against accidental contact, specify Roebling Weatherproof Wires and Cables.

Specifications for conductor, materials used for fibrous coverings, saturating and finishing compounds are in accordance with the ASA standards. As required by specification standards, Roebling Weatherproof Wire and Cable withstands bending around its own diameter—without harm to the braid or flaking of the finish.

Available in solid or stranded conductor—double or triple braid with flaked mica or black wax finish. Sizes 2000 M.C.M. to 14 A.W.G.



JOHN A. ROEBLING'S SONS COMPANY

TRENTON, NEW JERSEY • Branches and Warehouses in Principal Cities

with burning magnesium. It is a blend of various chemicals, can be applied directly to fire from container, or with scoop or other mechanical means, and has been approved by Factory Mutual Laboratories for fires in magnesium alloys. Amount in tube is said to have been proved by actual test ample to extinguish a 2-lb. magnesium-thermit type incendiary bomb.

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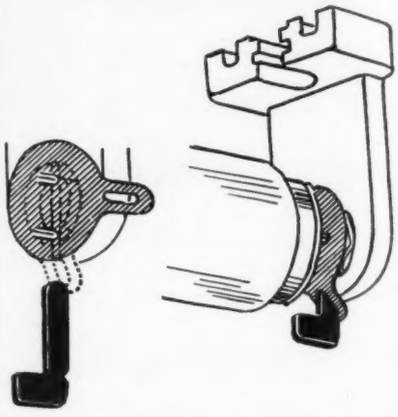
Lamp Lock

Addition to the company's line is a device for locking a fluorescent lamp against vibration. This patented device can



"Fluor-O-Lock No. FL10-41" lamp lock; for 10 to 40-watt fluorescent lamps, single slot sockets. **Laduby Company**, New Haven, Conn.

be installed by placing one lock on the contact prongs at each end of lamp. Then the lamp is set in sockets and keys inserted in socket slots. Lamp can be removed by releasing tab from key and removing key from lock at each end of lamp before turning the lamp.

•

Relay

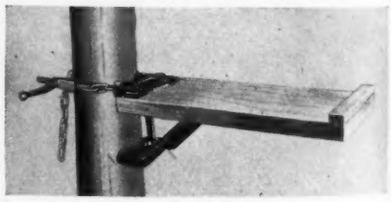
Mercury plunger relay; a.c. or d.c., rated 30 amp., 110 volts, 1 hp. **H-B Electric Co.**, 2530 North Broad St., Philadelphia, Pa.

Mercury plunger relay which has been redesigned is said to have the following gains: Metal cap and support frame that held the mercury tube were eliminated, thereby releasing strategic metals. Mercury tube was made secure by a single metal band which gives twice the stability of previous design. Area for terminal fastening and connecting was tripled thereby eliminating danger of tube breakage and simplifying installation.

•

Platform

Light-weight platform and brace are combined to form a solid unit which can



"Tips" economy platform, available in 24- and 30-in. lengths, supports weight of one man, tested to loads of 850 lb. without breaking the board. **A. B. Chance Co.**, Centralia, Mo.

NEWS ABOUT PEOPLE

R. E. Nock of Providence Assumes New Duties

Ralph E. Nock, whose election as vice-president of the Narragansett Electric Co., Providence, R. I., was recently announced, started work in the utility

field in 1912 as a clerk with the Rhode Island Co., which operated electric railway properties in Providence and vicinity. He was appointed assistant comptroller of the United Electric Railways, successor transit system, in 1927 and became comptroller a year later. In 1934 he was elected assistant treasurer and assistant secretary of the Narragansett company and at the same time was appointed treasury representative in the southern district of the New England Power System, with supervision over these activities of the Rhode Island properties of the New England Power Association group.

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▶ R. F. HARTENSTEIN, formerly director of lighting of the Ohio Edison Co., Akron, Ohio, has become associated with the Hygrade Sylvania Corp. as a special representative. He will spend the major part of his time working with the commercial departments of the various utilities throughout the United States. For the time being he will make his headquarters at the New York office of the corporation. Mr. Hartenstein joins Hygrade Sylvania after many years of experience in the public utility field.

▶ H. B. HIGGINS has been elected executive vice-president of the Pittsburgh Plate Glass Co. Mr. Higgins is a director of the company and has been a vice-president since 1928. He heads the company's merchandising division and has been active in sales and distribution throughout his business career. Mr. Higgins has been identified with the company since 1905.

•

A. C. Streamer Elected N.E.M.A. Vice-President

A. C. Streamer, vice-president Westinghouse Electric & Manufacturing Co., has been unanimously elected by the board of governors as a vice-president of the National Electrical Manufacturers Association. Mr. Streamer succeeds

Ralph Kelly, who recently resigned as Westinghouse vice-president to become executive vice-president of the Baldwin Locomotive Works.

Jaeger Heads New Utility Division for Hotpoint

To work with public utilities on war problems involving defense housing, army and navy camps and bases, Hotpoint has recently inaugurated a new

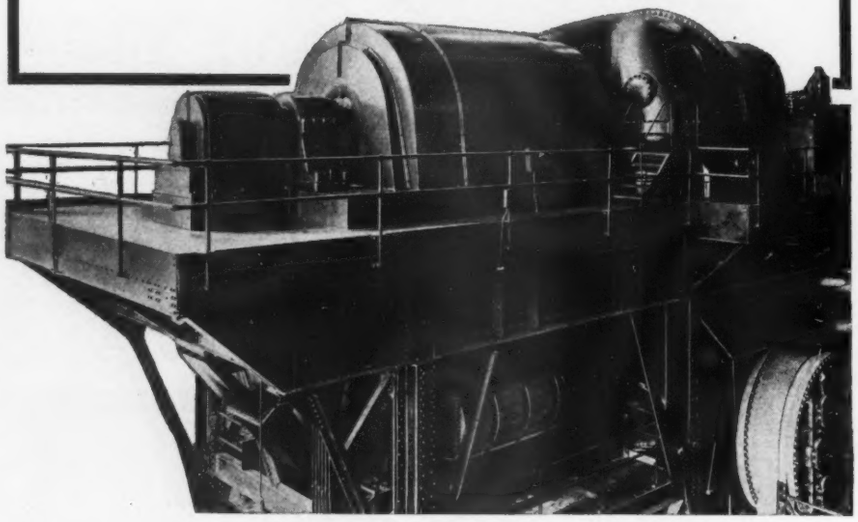
utility division headed by August H. Jaeger, who until recently has been manager of the water heater sales division, now merged with the range division under W. R. Schafer.

Well known among electric utility executives, Mr. Jaeger has served as chairman of the electrical water heating section of NEMA. He is president of the Chicago Sales Executives Club and an active member of the National Federation of Sales Executives. He has a background of 20 years service with Hotpoint.

With the sale of refrigerators, ranges, water heaters, home laundry and kitchen equipment on a priority basis, and merchandise sales by utilities reduced to a minimum or eliminated entirely, the Hotpoint program is one of future planning—cooperation with the utilities and distributors in laying the groundwork for directing the great flow of merchandise to consumers that is certain to follow the war period.

In announcing Mr. Jaeger's appoint-

When it's gotta glow it's GOTTA glow!



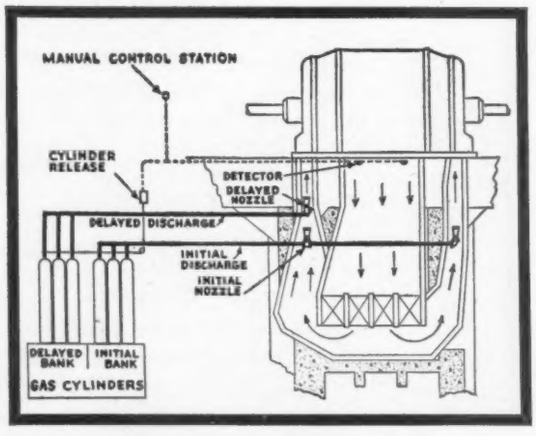
How to confine fire damage to point-of-rupture . . . kill flame and control glow

It's *flame* that does the damage to rotating electrical equipment. That's your *first* fire-fighting job. Nevertheless glowing embers of insulation must be controlled until the machine stops rotating. The fact is that, if *glow* is unchecked, *embers* may flare up at any instant.

Diagram shows how a Built-in LUX extinguishing system kills flame in time to stop damage. At the first sign of fire, LUX nozzles flood entire machine and ducts with carbon dioxide gas. Fast-spreading LUX gas spreads into every inch of space and kills flame instantly. LUX carbon dioxide is one of the fastest of all known extinguishing agents. Moreover, it is harmless to equipment.

Fire Control Lasts 30 Minutes

On a 30,000 K.V.A. generator a 12-cylinder LUX system is used. Five cylinders kill flame during first few seconds. Seven remaining cylinders discharge for 30 minutes until machine runs down. This continuing concentration of carbon dioxide completely kills all carbonaceous "glow".



Manual Or Automatic

Differential relays or thermostats automatically release LUX gas, shut off machine, at first sign of fire, or emergency manual controls snap the system into action when detectors indicate fire. Best practice combines both types of controls.

• • •

EXPLANATION — *Extinguisher nozzles, located in intake duct near underside of rotor, flood machine with carbon dioxide gas, kill flame instantly. Delayed discharge nozzles distribute sufficient gas to control glow during run-down period.*

Walter Kidde & Company

Incorporated

447 West Street **Bloomfield, N. J.**

ment, G. H. Smith, Hotpoint general sales manager, said:

"Hotpoint believes in full preparedness for war in times of peace, and, conversely, it believes in full preparedness for peace in time of war. Our entire manufacturing facilities are gradually being converted to war production. In the meantime, without losing sight of the important objective of winning the war, we intend to be in position to handle our share of the responsibilities of peace."

•

Poston Elected to Head Ohio Utility Company

John B. Poston has been elected president of the Columbus & Southern Ohio Electric Co. at the recent annual meeting of the board of directors. He succeeds B. W. Marr, who had been president of the company since 1929, and now continues as chairman of the board.

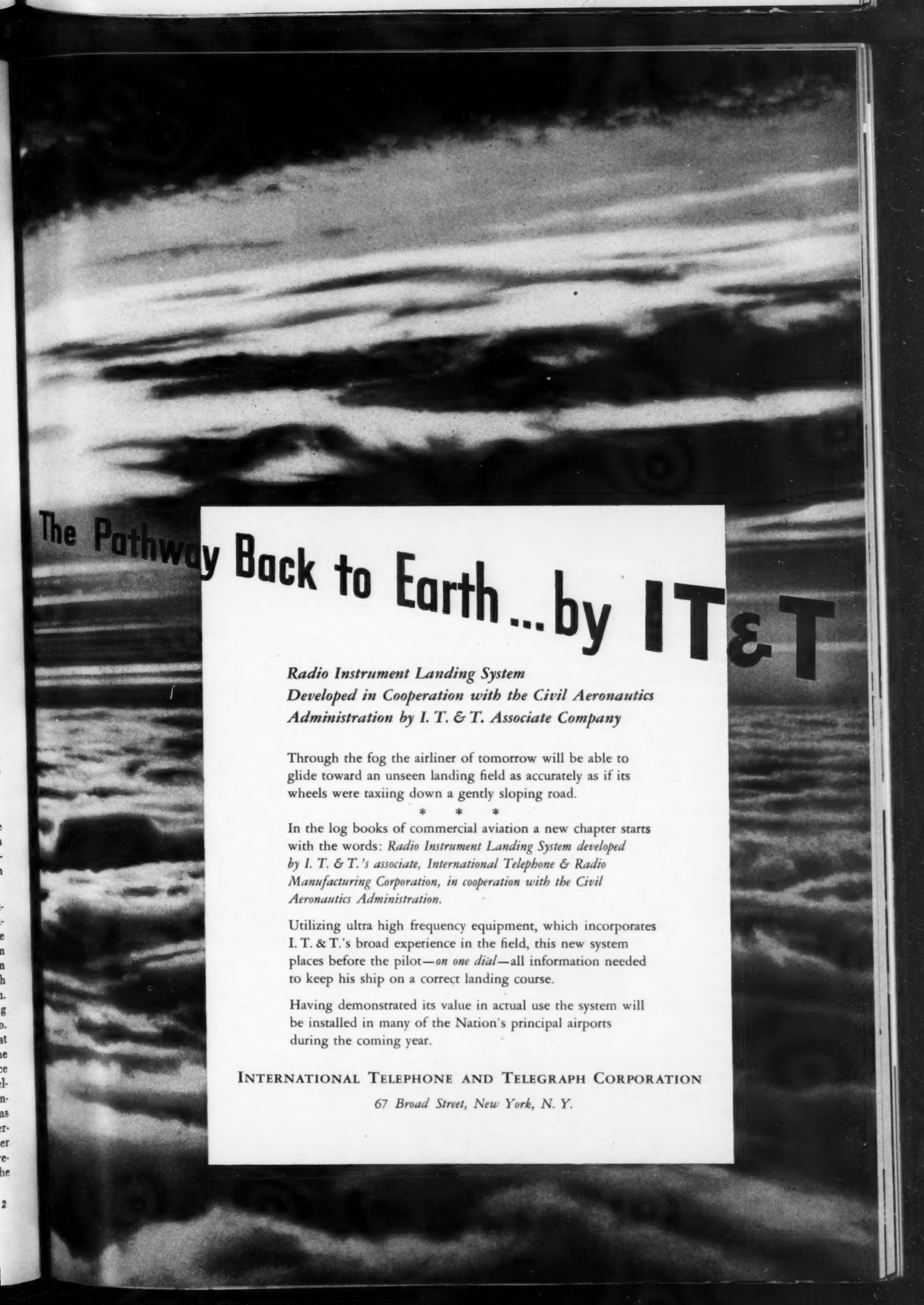
Mr. Poston received his education at the University of California. His first employment in the public utility field was in 1914 with the Hocking Power Co., founded by his father, which was a predecessor company of the Southern Ohio Electric Co., later merged with the Columbus Railway, Power & Light Co. to form the present company.

After serving several years as general manager of the Southern Ohio Electric Co., he was elected president in 1934. In 1931 he became a director of the Columbus Railway, Power & Light Co. and was made its executive vice-president in 1932, continuing in that capacity after the two companies were merged in 1937 into the Columbus & Southern Ohio Electric Co.

•

▶ GEORGE R. LUNN, a member of the New York Public Service Commission since 1925, has submitted his resignation to Governor Lehman. He has been in ill health for several months.

▶ R. L. HARRIS has been appointed superintendent of production of the Alabama Power Co., to succeed the late M. F. Neeson. Following graduation from the University of Alabama in 1923, Mr. Harris became identified with the Birmingham utility's drafting room. Later he engaged in some engineering work in connection with Gorgas No. 1 plant, becoming results engineer at Gorgas in 1925. Two years later he was transferred to the general office of the company to engage in miscellaneous duties incidental to the construction of Gorgas No. 2, as well as to work on various steam plant operating and maintenance problems. After serving at Magazine steam plant as results engineer and as assistant to the



The Pathway Back to Earth ... by IT&T

Radio Instrument Landing System
Developed in Cooperation with the Civil Aeronautics Administration by I. T. & T. Associate Company

Through the fog the airliner of tomorrow will be able to glide toward an unseen landing field as accurately as if its wheels were taxiing down a gently sloping road.

* * *

In the log books of commercial aviation a new chapter starts with the words: *Radio Instrument Landing System developed by I. T. & T.'s associate, International Telephone & Radio Manufacturing Corporation, in cooperation with the Civil Aeronautics Administration.*

Utilizing ultra high frequency equipment, which incorporates I. T. & T.'s broad experience in the field, this new system places before the pilot—*on one dial*—all information needed to keep his ship on a correct landing course.

Having demonstrated its value in actual use the system will be installed in many of the Nation's principal airports during the coming year.

INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

67 Broad Street, New York, N. Y.

WE HAVE BEEN DOING THIS TOO LONG

We have been hiding a light (figurative, of course) under a bushel. We mean the untiring, behind-the-scenes work of our research and design staffs who are working today on the problems of *tomorrow's* lighting. When new light sources are developed, Silv-A-King equipment will be ready to put them to the most effective use. For 21 years this policy of *looking ahead* has been a major factor in establishing Silv-A-King's reputation as lighting specialists throughout industry. Bright Light Reflector Co., Inc., 1035 Metropolitan Ave., Brooklyn, N.Y.

Write for one or both of these Silv-A-King Lighting Guides: LG1 — Fluorescent, or LG2 — Incandescent.

A Few Typical Silv-A-King Users:

AC SPARK PLUG
GENERAL MOTORS
FISHER BODY
INTERNATIONAL HARVESTER
JONES & LAUGHLIN STEEL
PITTSBURGH PLATE GLASS
and many others

SILV-A-KING MAKES *Light* WORK FOR YOU

superintendent of the plant, he became office engineer and was appointed mechanical engineer and inspector on the construction of the Chickasaw steam plant in 1940. Upon his return to Birmingham in 1941 he was named assistant superintendent of production.

•

Puget Sound Power Makes Changes in Personnel

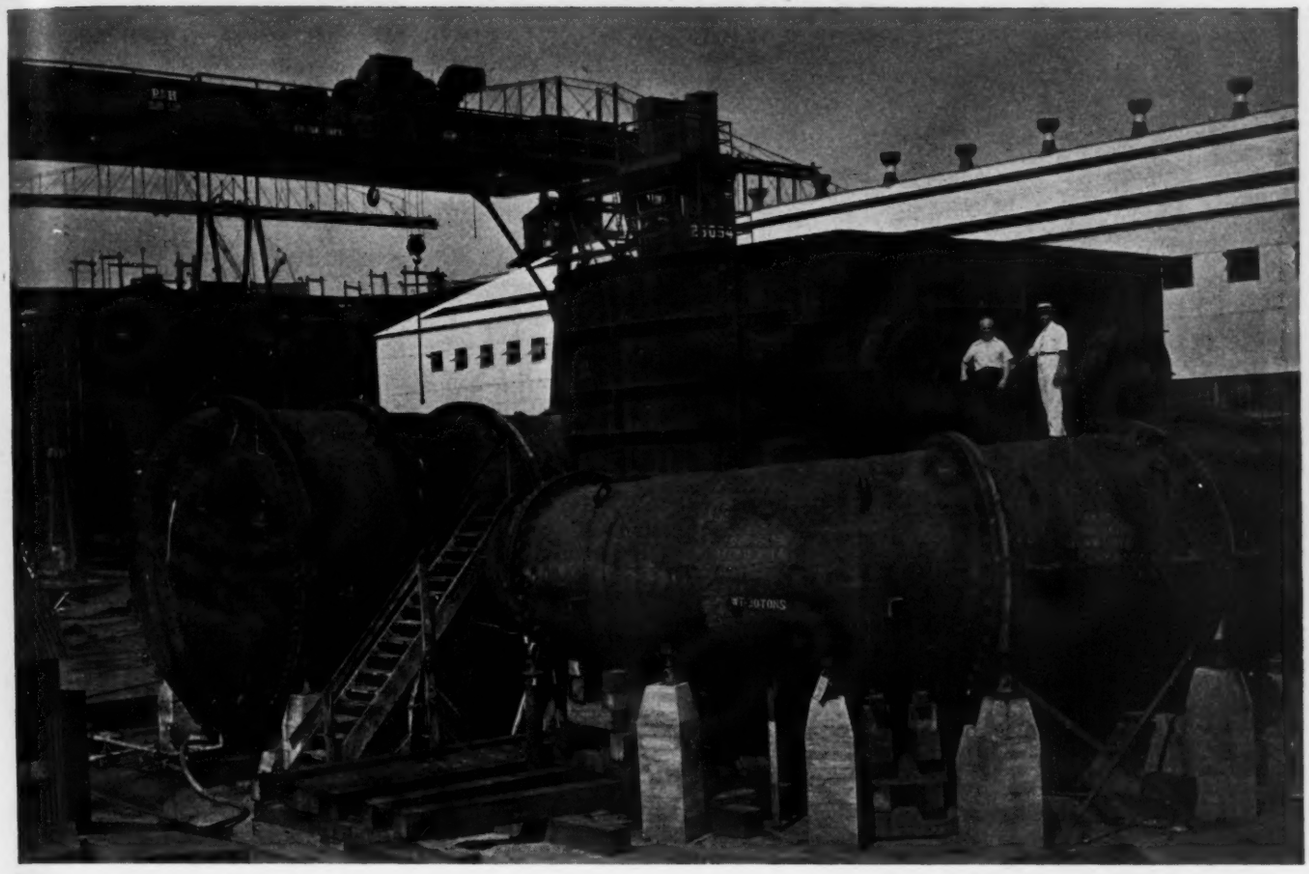
Two important changes in the executive personnel of the Puget Sound Power & Light Co. have been announced

H. Kruse

C. Hess

by Frank McLaughlin, president of the company.

Henry Kruse, for the past five years sales promotion manager, has been promoted to the office of northern division manager with headquarters in Bellingham, Wash. He succeeds John Hickok, who announced his retirement last month. Succeeding Mr. Kruse is Charles Hess. Mr. Hess has been with Puget Sound Power & Light for eighteen years and was formerly merchandise supervisor.



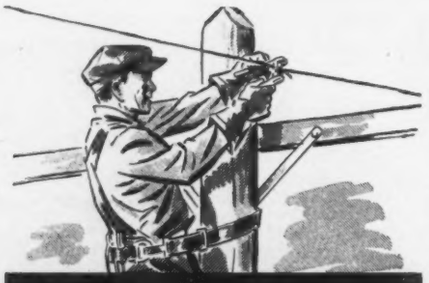
150,000 HP Francis Turbine for Grand Coulee Project

(SHOP HYDROSTATIC TEST—230 LB. PER SQ. IN.)

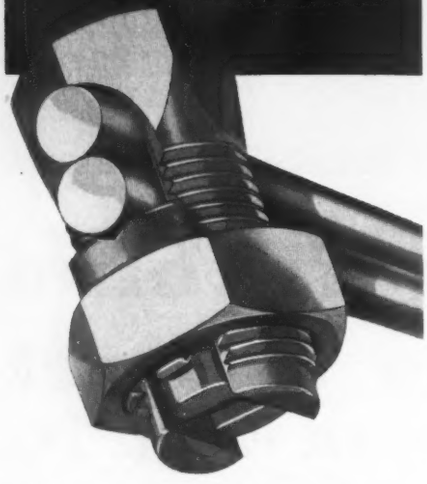
HYDRAULIC TURBINES

Francis and High Speed Runners
Butterfly Valves
Power Operated Rack Rakes
Gates and Gate Hoists
Electrically Welded Racks

Newport News Shipbuilding and Dry Dock Company
(Hydraulic Turbine Division)
Newport News, Virginia



L-M connectors are *really* re-usable



When we say L-M Connectors are re-usable we mean that after being used for long periods of time at high contact pressures nuts move so freely on the threads that you can turn them with your fingers.

L-M Connectors provide high re-use value because of the careful machining of body and nut threads. This machining gives them the strength to withstand high pressure tightening without damage.

LINE MATERIAL CO.

MILWAUKEE LM WISCONSIN

Mr. Kruse entered the service of the Puget Sound utility in 1923 following graduation from the University of Washington. After serving as manager in Port Townsend, Wash.; assistant sales manager in Bremerton, Wash.; assistant sales manager in Olympia, Wash., and division sales manager of the company's eastern division and Everett, Wash., district, he was transferred to Seattle as sales promotion manager.

Mr. Hess became identified with Puget Sound Power & Light in 1924 after a varied career in the electrical field.

•

Organization Changes Announced in New York

Harry Y. Hall, superintendent of Waterside station, Consolidated Edison Co., has been appointed production superintendent, to succeed A. J. Wheeler, Jr., who left the production department to become assistant process engineer in the newly formed process control department under C. A. Lunn.

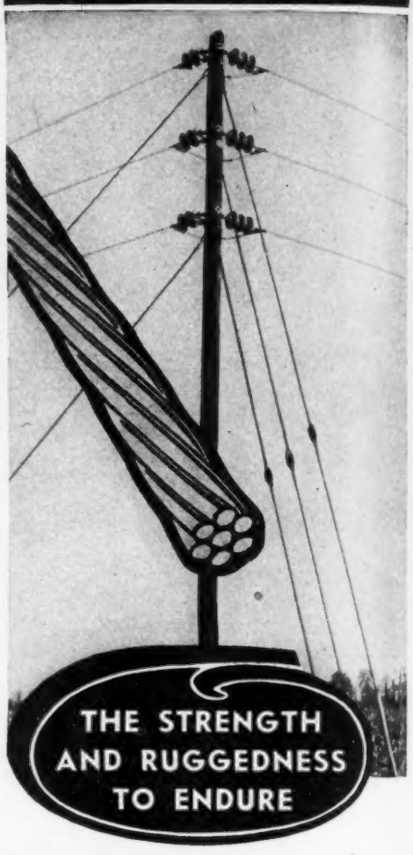
Other production changes were chiefly along the line of segregation of electric and mechanical supervisory functions in electric stations of the system. At Hudson Avenue station Harold A. Bauman, assistant superintendent, became electrical superintendent and Joseph G. Callahan, assistant superintendent, became mechanical superintendent. Samuel F. O'Sullivan, assistant superintendent at Waterside station, was named electrical superintendent and William J. Angus, assistant superintendent, became mechanical superintendent of that station. At Hell Gate station Ralph H. Lawson, assistant superintendent, was made electrical superintendent and H. K. LeSure, assistant superintendent, was made mechanical superintendent. William M. Henry's title of superintendent at East River station was changed to that of station superintendent.

Following the retirement of Charles E. Marks as superintendent of Sherman Creek plant, Alexander Elterlein, formerly electrical foreman at East River station, was named electrical superintendent of that station and Robert J. Murphy, assistant superintendent, became mechanical superintendent.

•

► HOWARD COONLEY has been appointed chief of the simplification branch of the Bureau of Industrial Conservation, War Production Board. Mr. Coonley, chairman of the board of the Walworth Co., replaces Dr. Edwin W. Ely, who recently was called back to his position as chief of the division of simplified practice of the National Bureau of Standards. Dr. Ely was loaned to the

Crapo GALVANIZED STEEL STRAND



STRENGTH to support the pole structure under maximum ice and wind loading ... RUGGEDNESS to withstand the punishment incurred in construction and service .... DURABILITY that outlasts the normal life of the line .... are combined---with important ECONOMY---in *Crapo* Galvanized Steel Strand.

Each size and grade develops the full tensile strength of the steel in cross section. The heavy, ductile, tightly-bonded zinc coating---applied by the famous *Crapo* Galvanizing Process---provides lasting protection against corrosion.

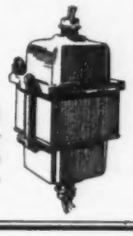
There is a size and grade of *Crapo* Galvanized Steel Strand for every practical need. Consult the distributor of *Crapo* Galvanized Products near you or write direct for further information!

INDIANA STEEL & WIRE CO.
MUNCIE, INDIANA

AS THE ARCHITECT *PLANS*...

Above — AmerTran power transformers available for all requirements in sizes to 10,000 KVA., 132 KV.

Left — AmerTran distribution transformers of either oil or non-inflammable-liquid immersed type available in sizes to 500 KVA., 72 KV.



Right — AmerTran air-cooled transformers for either indoor or outdoor service are available for all industrial requirements—sizes to 150 KVA.

PLANNED, designed and constructed to withstand safely every stress and load of a specified service . . . this is how modern steel structures (bridges, for example) are created, and likewise this typifies the manner in which AmerTran Transformers are produced. Our transformers are not all of one basic type which is modified to meet varying requirements of voltage and capacity. Instead we have developed what is probably the most diversified line of transformers offered by any single manufacturer, including many distinctly different types, each for a specified type of service and each available in a wide range of ratings. Moreover, AmerTran equipment is manufactured by an organization with over 40 years experience in meeting the exacting transformer requirements of electric utility companies and industrial plants. May we recommend suitable equipment for your needs?

AMERICAN TRANSFORMER CO., 178 Emmet St., Newark, N. J.

Manufactured Since 1901 at Newark, N. J.

AMERTRAN

Built to your Specifications

HIGH conductivity

LOW voltage drop

FARGO

connectors

The "vise-like" grip of Fargo Connectors is the result of unique design and perfect machining of body and bolt.

The same careful machining results in high pressure contact between conductors and insures high conductivity with low voltage drop at the joint.

Another result of careful machining is the frequency with which Fargo Connectors may be reused over a long period of time.

Made by FARGO MFG. CO.
distributed by

LINE MATERIAL CO.
MILWAUKEE WISCONSIN

Bureau of Industrial Conservation last fall. Mr. Coonley is a past-president of the National Association of Manufacturers and of the American Standards Association and is now a director of A.S.A.

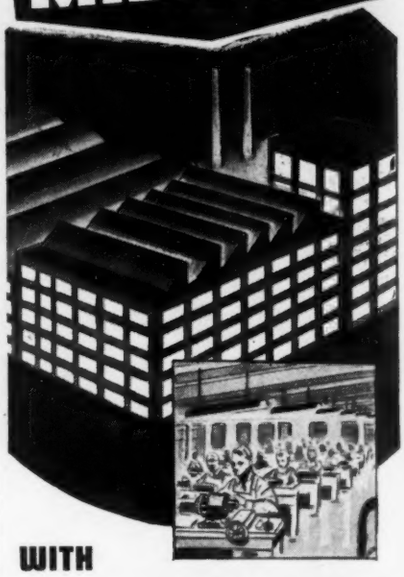
▶ RICHARD CUTTS, JR., New England district meter specialist of the General Electric Co., Boston, has been transferred to the meter division of the central station department of the company at the West Lynn factory, where he will be given special assignments. Mr. Cutts was graduated from the Massachusetts Institute of Technology in 1928 and has been employed by G.E. in the meter engineering department at the Schenectady works and in the New York office, going to the Boston office in 1937. He has been succeeded at Boston by RICHARD W. KUNKLE, a 1937 Cornell graduate, who went through the G.E. test course, worked in the West Lynn engineering offices and joined the meter division early in 1941.

▶ REESE MILLS has been appointed assistant manager of the Westinghouse merchandising division and T. J. NEWCOMB sales manager for merchandise products. FRANK R. KOHNSTAMM, sales manager of the division since 1939, has resigned. Mr. Mills will direct sales administration and product service activities of the division. He has been with Westinghouse since 1919, and since 1940 has been assistant merchandise sales manager. Mr. Newcomb will have charge of merchandising sales and advertising and will direct the division's field organization. He has been identified with Westinghouse since 1929. Mr. Kohnstamm joined Westinghouse in 1917 and has been engaged during that time with the company in its merchandising, lighting and sales promotion divisions.

▶ FOSTER K. SAMPSON, illuminating engineer on the staff of Southern California Edison Co., Ltd., Los Angeles, has been placed in charge of a newly formed contract and record section established by that utility. This section is part of the commercial department and is designed to concentrate in one office the contracts between the company and its commercial, industrial and governmental consumers for uniformity and reference. Mr. Sampson, an architect as well as illuminating engineer, has been chairman of the Southern California section, I.E.S.

▶ WILLIAM H. T. JONES, system commercial manager of the Consolidated Edison Co. of New York and formerly assistant treasurer of the New York Edison Co., has retired from active service with the company. Mr. Jones completed 48 years of service with the company last December. He joined the North River Electric Light & Power

DAYLIGHT at MIDNIGHT



WITH

FLUORESCENT LIGHTING

. . . and twelve o'clock noon lighting at twelve o'clock midnight is economical lighting when you use G-E Fluorescent Starters. Economical because . . .

They help your lamps to last longer! How? G-E Starters are designed by Mazda Lamp engineers to have the correct starting characteristics to start your lamp at the *exact* proper time — not before, not after. There is no needless waste of emission material (vital to long lamp life) when you use G-E Starters.

G-E "NO-BLINK" STARTERS

Even the annoying blinking and flickering at end of normal lamp life is eliminated and starter life is prolonged by using the "No-Blink" starter, developed and introduced by General Electric.

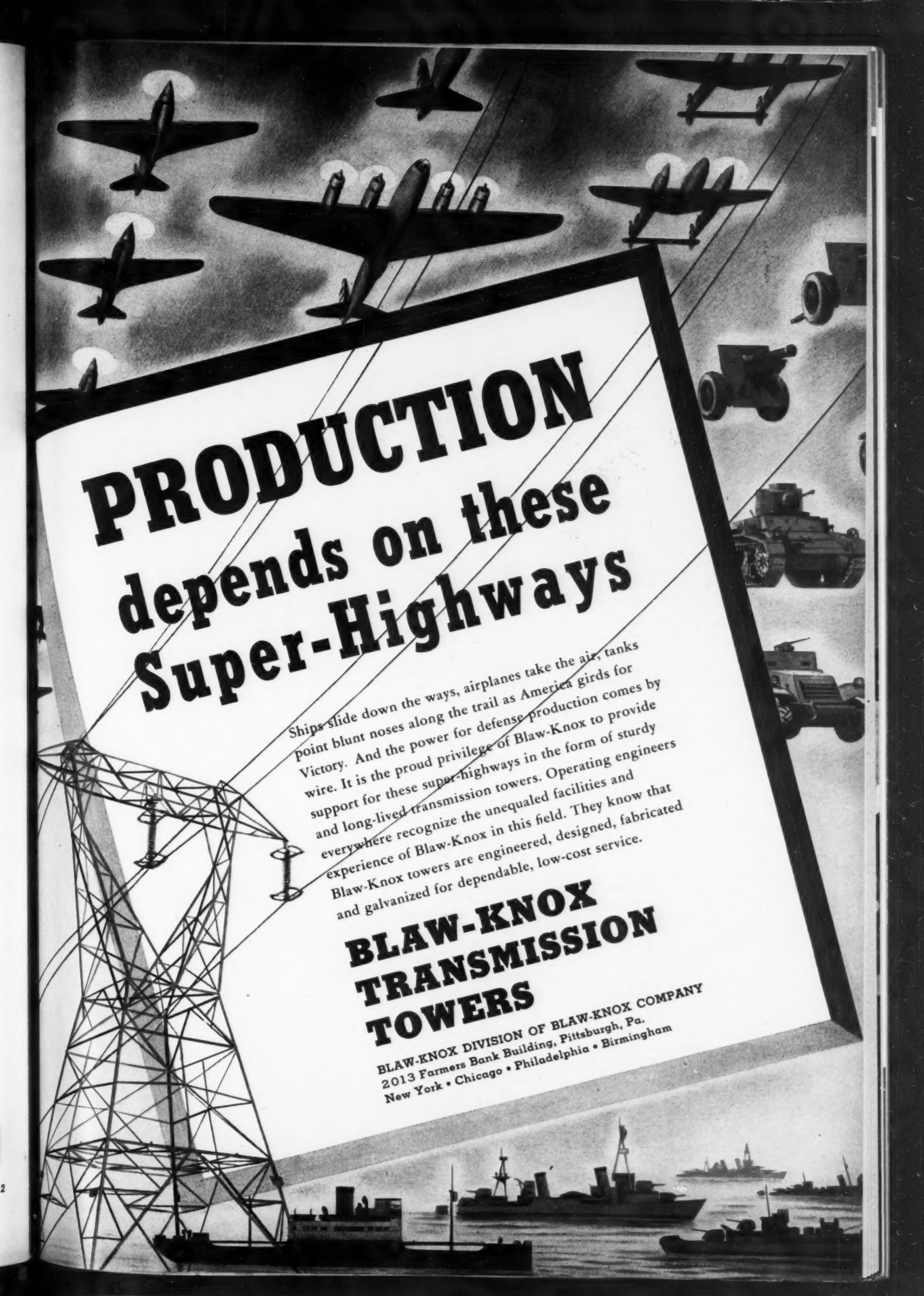
For economical, trouble-free lamp operation, specify G-E Starters for your fluorescent lighting equipment.

The Key

TO ECONOMICAL FLUORESCENT LIGHTING

A new fact-packed folder giving helpful information on fluorescent lighting and the need for proper accessories is now available. Get yours by writing to Section G-294, Appliance and Merchandise Department, General Electric Company, Bridgeport, Connecticut.

GENERAL ELECTRIC


PRODUCTION
depends on these
Super-Highways
Ships slide down the ways, airplanes take the air, tanks point blunt noses along the trail as America girds for Victory. And the power for defense production comes by wire. It is the proud privilege of Blaw-Knox to provide support for these super-highways in the form of sturdy and long-lived transmission towers. Operating engineers everywhere recognize the unequaled facilities and experience of Blaw-Knox in this field. They know that Blaw-Knox towers are engineered, designed, fabricated and galvanized for dependable, low-cost service.
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TOWERS
BLAW-KNOX DIVISION OF BLAW-KNOX COMPANY
2013 Farmers Bank Building, Pittsburgh, Pa.
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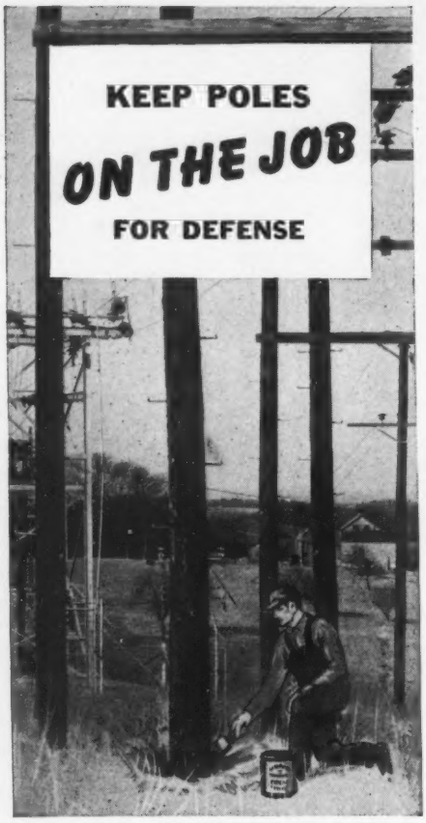


● Osmoplastic treatment prevents groundline decay thus increasing standing pole life.

In these critical times, it is important that poles keep standing longer to avoid power failures. You can guard against pole failures due to groundline decay by using the Osmoplastic groundline treatment. This easy to apply wood preservative increases standing pole life by 7 to 10 years. In addition, frequent pole inspection is eliminated. Osmoplastic groundline treatment is economical, too. Service records of over 60 leading utilities compiled from over a million Osmoplastic treated standing poles prove Osmoplastic pays. Make inspection time Osmoplastic time for lowest cost pole protection.

SEND coupon below for full information

OSMOSE
WOOD PRESERVING COMPANY
Buffalo, New York

Osmose Wood Preserving Company
Buffalo, New York
Please send me complete data on the Osmoplastic groundline pole treatment.

Name_____

Company_____ Title_____

Address_____

City and State_____

Co. in 1893 in the capacity of general office boy in the company's building in the Bronx. Mr. Jones received many promotions as the years went by, and in 1932 he was made an assistant treasurer of the New York Edison Co., having at the same time the title of chief, Bureau of Accounts, in the Bronx. In 1934 he was transferred to the Irving Place office and in 1936, when the New York Edison and Consolidated Edison companies were merged, he became system commercial manager.

OBITUARY

► HARRY G. STEELE, president of U. S. Electrical Motors, Inc., for the past 22 years, died at his home in Pasadena, Calif., on April 2, at the age of 60.

► ALBERT R. WEBB, 84, retired sales manager of the American Steel & Wire Co., Worcester, Mass., died at the Hahnemann Hospital, Worcester, on March 21. He was widely known in the electrical field in earlier days.

► JAMES F. RAWDON, at one time an operating engineer in the steam plant of the Narragansett Electric Co., Providence, R. I., and long connected with the federal inspection of boilers, died at a Boston hospital on April 2, aged 63.

► RICHARD H. LANG, superintendent of power transmission for the Consolidated Gas, Electric Light & Power Co. of Baltimore, died suddenly, on April 4, in his fifty-ninth year. A native of Pittsburgh, Pa., Mr. Lang had been a resident of Baltimore since his childhood. He had been employed by the Baltimore utility for 40 years.

► ALEXANDER C. LANIER, professor of electrical engineering and chairman of the department of electrical engineering, University of Missouri, Columbia, died on February 26. He was 63 years of age. Professor Lanier received his technical education at the University of Tennessee and at Harvard University. From 1900–1902 he was associated with the General Electric Co., then joined the teaching staff of the University of Tennessee and later of the University of Cincinnati. In 1909 he entered the employ of the Westinghouse Electric & Manufacturing Co. in East Pittsburgh, Pa., as design engineer and from 1911 to 1915 he was section engineer in charge of design of d.c. generators and motors. In 1915 he was appointed professor of electrical engineering and chairman of the department of electrical engineering, University of Missouri. Professor Lanier was a fellow of the American Institute of Electrical Engineers and a member of the Society for the Promotion of Engineering Education.

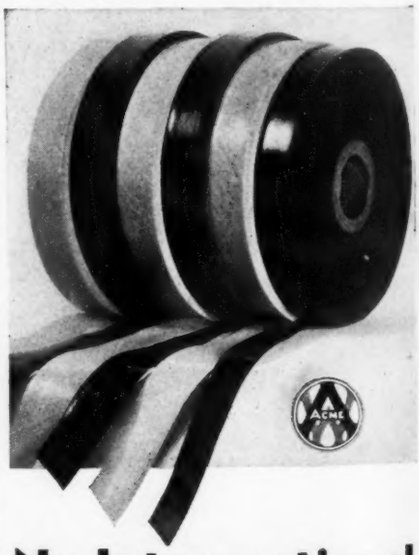
"SAFETY-PULL"
Just What Its Name Implies
And It's Giving Thousands of SAFE
PULLS and LIFTS
to help speed up our "American Victory Program"

COFFING'S

New Improved Model G Series "Safety-Pull" Ratchet Lever Hoists are built in convertible capacities ranging from ¾ to 15 tons, yet they weigh only 14 to 150 pounds. Greatly increased production facilities make it possible to give immediate service. For further information consult your supply house or write for our Catalog No. EG-5

COFFING HOIST COMPANY
800 Walter Street Danville, Illinois

RATCHET LEVER HOISTS
SPUR GEARED HOISTS
ELECTRIC HOISTS
LOAD BINDERS
TROLLEYS DIFFERENTIALS

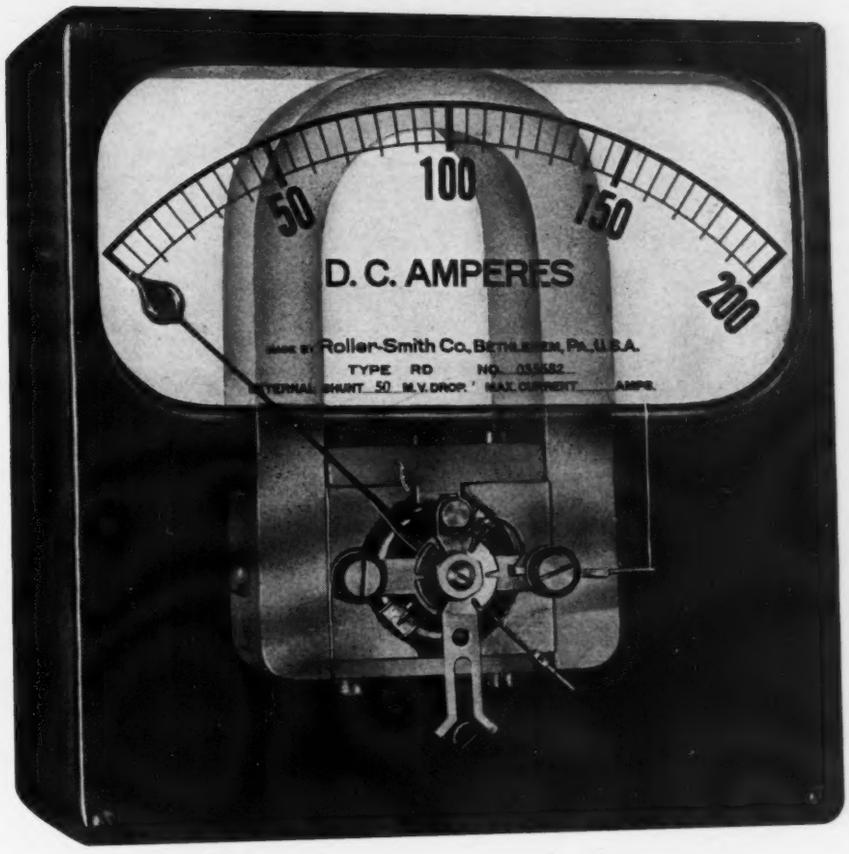


No Interruptions!

TODAY, power failures may be more than inconvenient; they may actually endanger the Nation's safety, for most defense plants stake their deliveries on uninterrupted current. Knowing that insulation is a vital link in rendering continuous service, utilities are standardizing more and more on Acme Varnished Tapes . . . nationally known for high dielectric, superior strength, and the good stretch needed for snug fits. Samples on request. Address *The Acme Wire Co., New Haven, Conn.*

Acme Wire Products
VARNISHED INSULATIONS — MAGNET WIRE
COILS

BEHIND THE DIAL



A New Movement with 4 Improved Features

You'll find no difference in the **exterior** appearance of the Roller-Smith types RD and SD switchboard instruments. The attractive cases . . . the easy-to-read dials are unchanged.

But behind the dial is a completely new movement. Compare its performance with any other instrument available today . . . and you'll see the value now offered in the new RD and SD designs.

These 4 NEW FEATURES will improve Your Instrument Performance

1. Overload capacity increased to 30 times normal by use of one piece pointer cross arm construction. Therefore, the instrument can sustain repeated overload shots and retain its normal accuracy.

2. Temperature errors only .09% per degree Centigrade change.

3. Improved damping results in an overshoot of only 1/25 of the distance the pointer is deflected. Thus readings can be made more quickly.

4. Time required for pointer to come to rest is less than one second.

In addition you'll find such features as 1% accuracy . . . 750 volt insulation . . . generous size tungsten steel magnets . . . and enameled dials.

Even though our efforts are devoted primarily to War production, improvements constantly are being made in R-S products. This is your best indication of even better equipment to be available in the future.

Electrical Measuring and Protective Apparatus

ROLLER-SMITH COMPANY BETHLEHEM, PENNA.

Switchboards • Metal Enclosed Switchgear • Electrical Instruments
Indoor and Outdoor Oil Circuit Breakers • Air Circuit Breakers

MANUFACTURING-MARKETS

Manufacturers Tell of "All-Out" Efforts

Executives of seven manufacturing companies recently revealed the extent of conversion of their production facilities to the war effort.

General Electric has thrown into wartime production every available employee, has added to its manufacturing facilities beyond the company's wildest peacetime dreams and its 130,000 workers—50 percent more than a year ago—are committed to a determination of victory against the aggressors in this war, Charles E. Wilson, president, declared last week in Boston.

Almost $300,000,000 of orders have been booked by Westinghouse since the first of the year, according to George H. Bucher, president, who added that "substantially all work" in the company's plants is for the nation's war effort. "In the face of conditions," he cautioned, "no predictions as to future results are of much value."

Allis-Chalmers has prepared a brochure "We Work for Victory and We Plan for Peace," as well as a sound moving picture with the same theme and title, to show what products this company is making under wartime conditions, reports W. C. Buchanan, president.

C. Donald Dallas, president of Revere Copper & Brass, recently announced that his company and most of its regular customers are engaged 100 percent in manufacturing materials for the war program. Shipments last year, he added, were the largest in the company's history and almost 2½ times as much as in 1939. Last year marked the completion of a mill in New England enabling the rolling of wider and heavier sheets and plates, which plant meets war demands for condenser heads for the power plant program and for shipbuilding.

The alloy steel plant of the Copperweld Steel Co. in Ohio, which produces electric furnace alloy steels, is devoted practically 100 percent to war production, according to S. E. Bramer, president, and has established a continuous operating record since it went into commercial operation on October 1, 1940.

Production Rallies

An all-out-for-war production rally of management and employees of Johns-Manville was held last week at the company's second largest plant at Waukegan, Ill., as part of a company-wide war production drive. Lewis H. Brown, president, declared, "We're 100 percent out to win this war."

And Burndy Engineering Co., Inc., whose electrical connectors are being used in war materiel, this week inaugurated the "Burndy MPST (More Planes, Ships, Tanks) Month", with every employee pledged to cooperate to the fullest extent of his ability. Chief purpose of the drive, as announced by Bern Dibner, vice-president and general manager of the company, is to ". . . maintain higher standards of workmanship, eliminate wastage of time and materials, and increase production of these essential war products, to the end that a speedy victory may be achieved over America's enemies."

Orders for Motors Fall Off Sharply

Orders for motors and generators dropped sharply in February, with the NEMA index going from the record high of 469 in January to 343, a decrease of 126 points, or 27 percent. A year ago the index stood at 276.

Orders for transmission and distribution equipment continued upward during February. The index rose to 294, as compared with 286 in January and with 351 for February, 1941.

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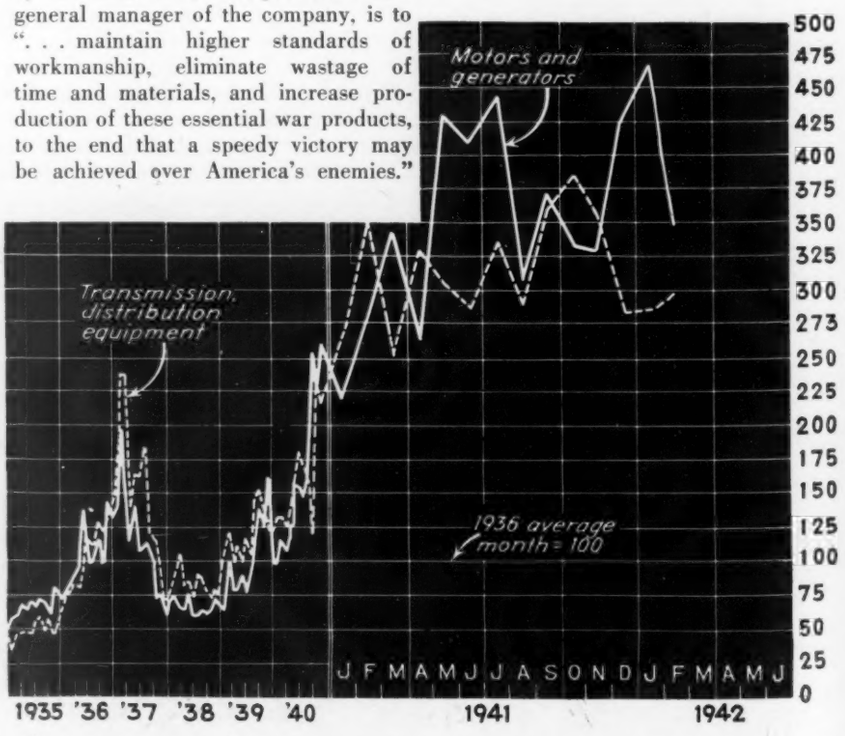
Range Sales Decline

Sales of electric ranges to continental United States, Alaska and Hawaii totaled 39,945 units in February, com-



NEMA INDEX, value of orders received for motors (large d.c., polyphase, synchronous) and generators (engine, belt-driven); also for transmission and distribution equipment

pared with 51,790 units in February, 1941, a decrease of 22.9 percent, according to the report issued by the National Electrical Manufacturers Association. For the first two months sales dropped to 70,141 units, from 102,306 units for the similar period of 1941, a decline of 31.5 percent.

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Manufacturers Issue Earnings Reports

Among the manufacturing companies recently issuing profit statements for the year 1941 are the following:

BABCOCK & WILCOX—Including wholly owned subsidiaries, net profit $4,252,000 after depreciation, amortization, federal income and excess profits taxes and $1,500,000 provision for contingencies. Profit is equal to $6.33 each on 671,970 shares, excluding 9.030 treasury shares, and compares with $3,582,188, or $5.34 a share, reported for 1940. Unfilled orders at the close of 1941 aggregated $120,674,573 compared with $88,712,936 a year earlier.

ELECTRIC STORAGE BATTERY—Including subsidiaries, year ended December 31, 1941, consolidated net income, $3,312,413 after provision for fluctuation in inventory values, loss on foreign exchange and $3,126,875 provision for state and federal income and excess profits taxes and estimated foreign income taxes. This is equal to $3.64 a share on 907,810 shares of capital stock in the hands of the public. In the year ended December 31, 1940, net income amounted to $2,167,592, equal to $2.38 a share on the same number of shares then outstanding. Sales continued to increase during 1941, totaling $47,553,169, compared with $33,151,906 in 1940.

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Fluorescent Lighting Group

Members of the newly formed War Production Board Fluorescent Lighting Fixture Industry Advisory Committee include: Arthur Miller, vice-president The Miller Co.; W. P. Lowell, Jr., Hygrade Sylvania Corp.; Joseph Markel, president Markel Electric Products, Inc.; Nathan H. Eglowstein, president Fluores-O-Lite Mfg. Co.

•

General Electric Forms New Electronic Section

As a result of the rapidly expanding field of industrial electronic control, an electronic control section has been organized in General Electric's industrial control division. Allen E. Bailey, Jr., and William D. Cockrell have been appointed as manager sales and engineer respectively of the new section. Mr. Bailey will report to G. R. Prout, manager of the industrial control division, and Mr. Cockrell to E. H. Alexander, engineer of that division.

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The Magnetrol is equipped with a single pole double-throw mercury to mercury switch. This permits the use of a line supervision circuit as well as an alarm circuit to provide instant notification to the operator in case the line to the Magnetrol is broken or tampered with.

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This dependable instrument operates on a simple time-proved magnetic principle, without any mechanical linkage between the float and the switch. It has no packing, bellows, diaphragms or electrodes. Its cost is insignificant in contrast with the value of the equipment it protects.

"One Magnetrol to a transformer" will provide the protection your company's power transformer needs. Full data on the unit... its installation and wiring ...are yours on request. Write us today.

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Field Reports on Business

Industrial electrical equipment is moving in good volume under the accelerated program of conversion to war production. Housing is playing a prominent part in the new war projects. Retailers are concerned over the possible consequences of over-all price ceilings.

PACIFIC COAST

Pacific Coast wholesalers report that partly by chance, partly by design, the larger plant, housing, camp and field projects have been so staggered that they have reached the bidding and electrical shipment stages in fairly regular succession with a consequently steady demand upon stocks and service. Housing was accentuated in last week's projects. A $10,000,000 Army air training center will be located at Carlsbad, N. Mex., and a $25,000,000 camp for 20,000 marines at Oceanside, near San Diego. First contracts are being placed for Columbia Steel's $126,000,000 steel plant and plate mill at Provo, Utah.

Other orders cover $87,150 Moloney transformers and $872,380 Westinghouse synchronous condensers for four Bonneville substations; and $23,362 Kelman switchgear, $15,731 G.E. carrier current equipment, and a $94,350 control house, all for Los Angeles, which is also requesting bids on the turbines and generators for four new power houses in the Owens River gorge and a 1,000-hp. steam turbine. Line material business includes a $212,380 low bid for the 23-kv. one-circuit steel tower line between Bonneville and Ampere and $38,829 for Columbia steel strand for three substation areas in Columbia Basin project.

California utilities are operating under an amendment to original federal regulations, and are limited to 250-ft. extensions costing under $500 for overhead or $1,500 for underground service. Recent industrial business reported from the San Francisco area includes $52,500 cable for Pearl Harbor; $100,000 G.E. switchgear for Mare Island; $23,000 voltage regulators for a cement plant; and $130,000 welding sets and electrodes.

NEW ENGLAND

Industrial electrical equipment is moving in good volume while the prospects for large scale commitments are appearing in the offing as a result of announcements of more factory expansion in this area. The War Department has authorized the construction of a $5,000,000 manufacturing plant in Massachusetts and has contracted for engineer-architectural and management services with Lockwood-Green Co., Inc., New York and Morton C. Tuttle Co., Boston.

Two airport projects involving directional and boundary lights will be constructed in this area by Edward J. Rappoli Co., Inc., Cambridge, Mass. Barracks, a radio school, and extensions to existing buildings of the U. S. Coast Guard School, Gallup's Island, Boston Harbor are to be constructed by Joseph E. Bennet Co., Boston. Construction of a magnetic detection loop station in Massachusetts has been awarded on a cost-plus basis to Richard White Sons, West Newton, Mass. Gamewell Co., Newton Upper Falls, Mass., has received a contract for an electric warning system involving $22,000.

New Britain, Conn., has installed fifteen siren signals. Providence, R. I., has purchased seventeen 2-hp. and six 5-hp. siren signals and more will be ordered. Small-lot orders for copper wire, wiring devices, and electric cable are steady. Government buying of grinding machinery, milling machines, and lathes, reflects many orders for small motors and automatic control and is advancing at a good rate.

Defense housing projects scattered among various centers engaged wholly in war production include 150 one-family houses opposite Norton Village, Worcester, Mass.; 300 homes costing $1,074,000 for the Springfield, Mass., district to be built by M. Spinelli, Boston, and 40 double houses, costing $250,000 for Wakefield.

NEW YORK

War expenditures are continuing to increase at a rapid rate. Substantial Government expenditures are reflected in a steady rise on the industrial front.

The expected slackening in trade after the Easter rush was realized last week when retailers in the Metropolitan area reported a drop of approximately 10 percent below the 1941 figures. Retailers are concerned over the consequences of overall retail price ceilings now held to be a certainty.

Engineering construction volume last week totaled $246,344,000, the third highest of the year. It topped the preceding week by 130 percent, and was 77 percent over the corresponding 1941 week, as reported by *Engineering News-Record*. This was the twelfth consecutive weekly total to exceed the $100,000,000 mark. The week's volume brought 1942 construction to $2,346,568,000, a 41 percent increase over the corresponding 15-week period last year.

CHICAGO

Rapid progress is being made in converting civilian industries to the manufacture of war materials. The first tangible results of a new all-out drive to utilize to the fullest extent the machine tools of small industry were disclosed last week. A total of 100 small manufacturers, mostly victims of "priorities unemployment," were given contracts aggregating $8,000,000 to produce ammunition components. Col. Donald Armstrong, deputy chief of the Chicago Ordnance District, stated that since December 7 contracts for army material placed in this district had increased from less than $500,000,000 to $1,938,000,000. Of that amount $1,136,000,000 has gone to more than 1,000 manufacturers in the metropolitan area.

Commonwealth Edison Co. predicts that the war production demands for electric power will rise from 15 percent last December to 45 percent of the total output in the Chicago area by winter, 1943-44.

A contract in excess of $5,000,000 was awarded to Edison G. E. Appliance Co. for procurement and installation of equipment and operation of a plant at an undisclosed location. Orders placed for electrical equipment last week included American Automatic Electric Sales Co., relays, $4,476; Graybar Electric Co., bus duct system, $3,648 and 120 fluorescent fixtures, $3,764. Chicago Flexible Shaft Co. recently installed 74 motors totaling 323 hp. The ordnance department has requested bids on wire and cable, grips and clamps, motors, rectifiers, heaters, insulators, lighting fixtures, switches, plugs and fuses.

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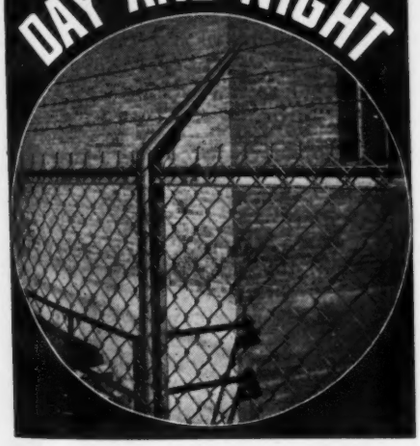

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Sales Opportunities

CHICAGO, ILL.—Commonwealth Edison Co., plans three-story addition, about 35x 75 ft., to Roseland power substation, enclosed-type. Bids are being asked for construction of building and award is scheduled to be made soon. Equipment installation will be carried out by company forces. Transmission lines will be extended in same district for increased power supply and extensions made in distribution lines. H. C. Von Holst, 140 South Dearborn Street, is architect for station structure.

BLYTHEVILLE, ARK.—Navy Department, Constitution Avenue and Eighteenth Street, N.W., Washington, D. C., has authorized new Air Corps training school in vicinity of Blytheville, comprising group of hangars, machine and mechanical shops, storage and other service buildings, administration building, barracks and miscellaneous structures. A power substation will be built, with complete electric distribution system and facilities for light and power service, including underground lighting system in different areas; an airfield lighting system will be installed. Motors and controls, switchgear, conveyors and other equipment will be installed for shop and industrial service. Entire project will cost in excess of $5,000,000, and will be in charge of United States Engineer Office, Memphis, Tenn., district.

BUFFALO, N. Y.—Farrel-Birmingham Co., Ansonia, Conn., with branch plant at 344 Vulcan Street, Buffalo, manufacturer of gears and gear drives, heavy machinery and castings, etc., plans installation of motors and controls, transformers and accessories, switchgear, electric conduits, power wiring, industrial lighting system, electric cranes, electric hoists, conveyors and other equipment in new plant in Northern New York (exact location withheld) for production for government. A power plant will be built, with several transformer substations for works service. Entire project will cost about $4,000,000, with financing to be provided by Defense Plant Corporation, Washington, D. C., a federal agency. Work is scheduled to begin soon.

BEDFORD, IND.—Public Service Co. of Indiana, Indianapolis, Ind., has approved plans for new transmission line from point near Terre Haute, Ind., to Louisville, Ky., by way of Bedford, forming part of power pool of Louisville Transmission Corp., Louisville, which will construct new high-tension line from last noted city to South Nashville, Tenn., for power supply for TVA. First mentioned company will build new power substation and switching station at Bedford. Work is scheduled to begin at early date.

FORT WAYNE, IND.—Board of Public Works, City Hall, plans new indoor-type power substation on Pettit Avenue for municipal electric system. Also will make extensions in primary lines in same vicinity for connection with new station. Estimates of cost will be made soon.

MADISON, WIS.—Navy Department, Constitution Avenue and Eighteenth Street, N. W., Washington, D. C., plans new Air Corps training school in vicinity of Madison, where a large tract of land has been selected. It will consist of several hangars, machine and mechanical shops, storage and general service units, administration building, barracks and auxiliary structures. A power substation will be built, with

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electric distribution system and facilities for light and power service; an airfield lighting system will be installed. Motors and controls, switchgear and other industrial electric equipment will be installed in shops and other service buildings. Work on project will begin at early date, with cost estimated in excess of $5,000,000. United States Engineer Office, Milwaukee, Wis., will be in charge.

GRAND COULEE, WASH.—Bureau of Reclamation, Denver, Colo., receives bids until May 4 for six 5,000-amp. bus structures, complete with current transformers, potential transformers, and generator-protective lightning arresters and capacitors for generating units L-4 to L-9, inclusive, Grand Coulee hydro-electric generating station, Grand Coulee, Columbia Basin project (Specifications 1030). Equipment will be installed by government.

SPOONER, WIS.—Spooner Municipal Utilities have plans maturing for new municipal hydroelectric generating station, and will make application for permission to proceed with project in near future. Cost reported about $250,000. L. A. DeGuere, Wisconsin Rapids, Wis., consulting engineer, is making surveys and plans for development, which will include extensions in primary and secondary lines in different parts of municipality.

WICHITA, KAN. — Atchison, Topeka & Santa Fe Railway Co., Topeka, Kan., has approved plans for addition to power plant at shops on Hiram Street, Wichita, and will begin work at once. No estimate of cost announced.

CHICAGO, ILL.—Pullman Standard Car Manufacturing Co., 79 East Adams Street, manufacturer of railway cars, parts, etc., plans installation of motors and controls, switchgear, transformers and accessories, electric conduits, power wiring, electric conduits, industrial lighting system, electric cranes and hoists, conveyors and other equipment in one-story addition, about 250 x 910 ft., at Cottage Grove Avenue and 110th Street, to be used for producion for government. Cost over $1,300,000. Work will begin soon. Burnham & Hammond, 160 North La Salle Street, are architects.

MONROE, LA.—United States Engineer Office, War Department, Mobile, Ala., plans installation of complete electric utilities at new Air Force Training School, vicinity of Monroe, including large power substation and number of small transformer substations, primary and secondary lines, and service facilities; also, airport lighting system, including underground cable, boundary and range lighting units, beacon and tower, etc. Entire project will cost over $5,000,000. Black & Veatch, 4706 Broadway, Kansas City, Mo., are consulting engineers.

WAUWATOSA, WIS.—Wisconsin Electric Power Co., Milwaukee, has approved plans for new enclosed-type power substation on South Ninety-Sixth Street, near Blue Mound Road, Wauwatosa, near Milwaukee. Also will make extensions in transmission lines for connection with new station. Work will be placed under way soon.

DETROIT, MICH. — Reichhold Chemicals, Inc., 601 Woodward Heights Boulevard, Ferndale, Detroit, manufacturer of synthetic resins, colors, industrial chemicals, etc., plans installation of motors and controls, transformers and accessories, switchgear, industrial lighting system, electric conduits, power wiring, conveyors and other equipment in new one and multi-story addition to plant. Cost close to $2,000,000, with machinery. Proposed to begin work this month.

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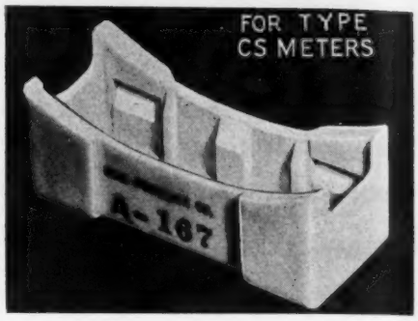

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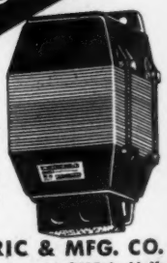

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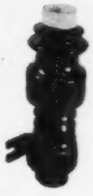

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LETTERS TO THE EDITOR

Theater Lighting

To the Editor of ELECTRICAL WORLD:

I am inclosing herewith an article taken from your last issue (Ed. Note—"Improved Theater Lighting Layout," March 21, 1942, page 69). It is possible that the material of this article is correctly printed, but, allowing for that, it still represents a "new law" in lighting technique! . . . when 3,000 watts gives 10 ft.-candles over 6,000 sq.ft. indirect at 40 percent reflection factor, I'll eat a plate of "lumens" with "foot-lamberts" for desert!

LIEUT. J. S. HAMEL,
U.S.N.R., C.E.C.,
New York, N. Y.

To the Editor of ELECTRICAL WORLD:

In reply to Lieut. Hamel's letter regarding my article on theater lighting, it is possible that the reading which he comments upon might have resulted at the time the installation was completed and for the following reason: There were installed twenty 150-watt lamps for white, ten 300-watt for blue and ten 150-watt lamps for red in the color cove. The color circuits were to be used with color filters and it may have been that the filters had not been installed when the readings were made and we might have obtained this reading with all 4,500 watts, or any of the combined integrals.

Your alert reader has discovered something in the article that has no important aspect in this particular job, *viz.*, efficiency. Since a theater is usually designed to attract customers, lighting is designed for effect and not for efficiency. These lights are used only in the "breaks" of the show and are in service probably less than an hour out of each day's operation of the house.

We have no established standards for this kind of illumination, and we had to do some "cut and try" work to find out just what the proper amount of light would be for this job. We do know that we obtained some highly satisfactory results and "effect" lighting and demonstrated some new uses for R-40 lamps. The job has pleased our client and we have used this principle many times since. It works better than any of the conventional cove lighting jobs.

. . . We are up to our eyebrows now in war building and lighting work and I cannot take the time to review the matter in detail with the Lieutenant,

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much as I would enjoy the argument. It would take a couple of days to run down the reasons for the figures quoted, under the present circumstances, and we haven't the two days!

FREDERICK M. HILL,
Electrical Engineer,
New Haven, Conn.

•

Oregon Co-op Signs New Bonneville Contract

Officials of the North Douglas Electric Cooperative, Inc., and the Bonneville Power Administration have announced that they have executed a new contract, which enables the cooperative to take advantage of Bonneville's new lower wholesale rate schedules to distributors. The original contract with Bonneville was rescinded.

The new contract is for 20 years and the increasing energy load of the cooperative necessitated an increase in the contract demand from 150 kw. to 500 kw. Provisions are included in the contract to permit the cooperative later to increase its contract demand for electric energy.

Contract also provides the cooperative will transfer 150 kw. of electric energy for the Bonneville Administration over its lines from Oakland to Drain. The Oakland-Drain lines were recently purchased by the cooperative from the California-Oregon Power Co. Drain also purchases and distributes Columbia River power under a contract with Bonneville.

•

Grand Coulee Dam Power Output Increasing

Bureau of Reclamation has announced that the Grand Coulee power plant delivered more power to the Bonneville Power Administration distribution system during the first 11½ weeks of 1942 than during the entire year of 1941.

Last year more than 200,000,000 kw.-hr. of energy was provided by the dam's first generators, two 10,000-kw. units, which began operating in March, and by the first main unit of 108,000-kw. rating, which took the place of the smaller machines early in October.

•

New Dry Battery Standard

A new American standard specification for dry cells and batteries, known as ASA Standard C18-1941, may be had from the Superintendent of Documents, Washington, D. C., at 10 cents each.

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Oregon Elections Favor PUD Bonds

Two PUD bond elections in Oregon in March resulted in favor of issuing $1,087,000 of bonds to buy out the West Coast Power Co. in two separate localities.

Central Lincoln County PUD, comprising a small area around the Yaquima Bay city of Newport on the Oregon coast, voted the PUD commissioners authority to issue $850,000 in revenue bonds, of which $750,000 is to pay for West Coast company's properties in Lincoln County, which incidentally extend outside of the presently constituted PUD area. The vote was 354 in favor of the bonds to 205 against.

Clatskanie PUD, comprising a small area around the city of Clatskanie on the Columbia River in Columbia County, Ore., voted 700 to 25 in favor of the issuance of $237,000 of revenue bonds, $175,000 of which is to go to the West Coast company for the purchase of its Columbia County property.

•

Court Decision Favors Village-Owned Plant

Rochester Gas & Electric Corp. and Despatch Shops, Inc., of East Rochester have lost the decision in the Appellate Division in their taxpayers' injunction suit to prevent the village of East Rochester from constructing the $360,000 village-owned electric light and power plant, approved at a special 1939 election.

The Appellate Division denied motions of the Rochester utility and the railroad car manufacturing company for reargument of the case before that court or for permission to appeal to the Court of Appeals in Albany.

•

French Plan to Develop Potential Water Power

Shortage of fuel has led the French government, according to reports received from France, to endeavor to complete numerous projects, including the harnessing of the Rhone.

A dam at Genissiat, just north of Bellegarde, is well under way. It will create a lake extending to the Swiss frontier, a distance of more than 14 miles. The plant, when it opens, will develop 250,000 kw.-hr., and eventually the annual production will be brought to 1,550,000,000. A second station is being planned near Montelimar.

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